



10th

Annual Yearbook Number

AVIATION

The Oldest American Aeronautical Magazine

McGraw-Hill Publishing Company, Inc. FEBRUARY, 1943. ONE DOLLAR PER COPY

BOLT FROM THE BLUE

Down, down, down, like a bolt from the blue, the Republic Thunderbolt dives on enemy aircraft with annihilating gun-fire.

To climb up top with heavy armament — to overtake the adversary with blazing speed — takes power. This Army P-47 gets it — 2,000 h.p. worth — from its dependable Pratt & Whitney Double Wasp.

PRATT & WHITNEY AIRCRAFT

EAST HARTFORD, CONNECTICUT

ONE OF THE FOUR DIVISIONS OF UNITED AIRCRAFT CORPORATION



Bubbles can cost Battles

THE advantage goes to the pilot who can get greater ceiling. At high altitudes, where atmospheric pressure is low, volatile aviation gasoline releases millions of tiny bubbles—dangerous bubbles that could form deadly vapor lock and cause failure of the fuel system.

Today, one item of over a thousand different parts made by Thompson is a precision-built fuel booster pump. These booster pumps, developed to lick the bubble problem, are being delivered in huge quantities. They enable

our bombers and fighting planes to climb into the stratosphere to dodge anti-aircraft fire and gain height advantage in air combat.

We are war workers. We cannot pilot the planes, aim the bombs, or man the gun turrets. But we can have a part—a vital part in Allied Nations' fighting on all fronts. Our challenge is to develop and build better parts and produce them faster and in larger quantities than the technicians and workers in enemy countries. To do that is the pledge of the



War Production Drive
LABOR-MANAGEMENT COMMITTEES OF
Thompson Products, Inc.
THOMPSON AIRCRAFT PRODUCTS CO.

Manufacturers of Automobile and Aircraft Parts
General Office: Cleveland. Plants in Ohio, Michigan, California, and Ontario, Canada.

Boasting Production Schedules on Vital Parts for Planes, Tanks, Submarines, PT Boats, Torpedoes, Jeeps, Half-Tracks, Tractors, and Trucks.

AVIATION

TENTH ANNUAL DIRECTORY NUMBER

February, 1943

Volume 42 • Eighth Edition • Number 2

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Sixth sense for Heroic Airmen

For the pilot speeding through storm and fog, absolute control over attitude and heading is vital. Yet with vision obscured, sense-direction to you and back can become confused... may possibly lead to disaster. Hence the need for a dependable, sensitive instrument such as the "PIONEER" Turn and Bank Indicator.

This fine example of advanced engineering shows the pilot, flying on instruments, the slightest deviation from his planned heading and lateral position. An all-time new important adjunct to aircraft navigation.

lation, the "PIONEER" Turn and Bank Indicator is a rate instrument... and thus aids in the execution of precision, smooth turns. Also, whether banking is more or indicated, its combination of the two instruments in a single case facilitates coordination of turn and bank movements.

Along with many other "PIONEER" flight, navigation and engine instruments, the Turn and Bank Indicator... vital "sixth sense" for our fighting fliers... is being produced in impressive quantities by the main and venture of Pioneer.

"PIONEER" aircraft instruments are used by members of "The Invincible Crew" precision instrument, and controls, which 35 battle planes have since been used are operating in our flying, crews in World War II.



PIONEER INSTRUMENT DIVISION

IF Hitler or Hirohito could spend an evening with the editorial staff members who prepared this, the 20th Annual Directory issue of Aviation from a tangled mass of names and facts and figures, the Aviation would be much clearer. As these dry statistics are intelligible and detailed, they emerge in an orderly procession of facts as formidable as it is convincing even to those who are averse to it.

The compact surface of a manufacturing industry so small that it comprises in dollar volume to the last check business in New York City, have needed to include the makers of almost any other product you may select. A real company new engine propellers, engine manufacturers now take out engine parts. The builders of our children's toys are making high precision instrument parts. Our engines, valves, and mechanical parts have turned into instruments and they like it. Factories have been made of gauges, testing tools, distributors, and even editors. Personnel training goes on night and day. Travel manufacturers are getting out of bed in the middle of the night to bolster the morale of third-class workers by rolling up their sleeves and working with them. Progression and development are the equivalent of which this manufacturing marvel is being made.

Manufacturing merges with operations in the maintenance shops of the airlines where modification work is growing. Our best fire string, traffic is almost impossible to plan.

If all adds up to a pretty impressive total in the directory of suppliers there are listed more than 2000 manufacturers, supplying an average of two and one-half products each to the aviation industry which includes aircraft manufacturers, airlines, engine manufacturers, fixed-base operators, and aviation schools. The aviation industry today ranks very near the top as a purchaser of materials and fabricated products.

The directory of manufacturers has been carefully improved this year. The product directory merely lists in alphabetical order the names of man-

ufacturers. Subscribers-Bureau of Aeronautics will observe that the "info size" of the current issue of the magazine is double smaller than that of previous numbers. The solution is also has been made to enable the publisher to send an order of the War Production Board listing the amount of paper that may be used in 1943. Subscribers will note, however, that as change has been made in size of type and in the amount of editorial content per page, but that a substantial saving in paper has been effected mostly by streamlining the matter.

The publisher has adapted the new size as a war measure and as a contribution to the economy of newspaper and transportation facilities in the production and distribution of paper. Service to the reader has not been sacrificed and will be maintained as far as is humanly possible in the face of the problems confronting all of us in our varied efforts to win the war.



T. F. Wright, Director of the Aircraft Research Control Office of the War Production Board. An export chart appears on page 111.

factories supplying these products. In a separate section may be found the addresses and key personnel of each of these manufacturers listed in straight alphabetical order. Aircraft, gliders, and engine manufacturers, as well as the airlines and schools are also listed with addresses and personnel in separate directory sections.

The general section containing photographs, illustrations, and descriptive text of American and foreign aircraft, as well as the detailed specifications tables of aircraft and engines, has been in the making for many months and is a comprehensive and authoritative compilation of its kind in existence anywhere. All types in current operation are listed and described. Members of the editorial staff have combed the wilderness for facts and material and have had the entire compilation thoroughly substantiated by every official source.

The American Division of Air Power has closed the test of battle and held fast to be the decisive factor in supporting

the Axis. In the first of a series of two articles, Major Nathaniel F. Gibbs describes this doctrine, tells when and how it was conceived, and highlights the careers of the men responsible for it. The article clearly shows that the successful air war being conducted by our air forces is the fruit of long planning by a group of men whose courage, vision and tactical brilliance facilitated in one phase a double-edged weapon of defense and offense. This is the story of American Air Power as it is—thoroughly tested, thoroughly successful. The fathers of it are not forgotten. They are active only of themselves. They are setting a noble example for the rest of the world.

Page 112

Transportation in the Pasture Period is a subject that is currently occupying the minds of many who are responsible for planning now and for the future. Mr. A. N. Kemp, president of American Airlines has been carrying on an aggressive campaign to give us fundamentally sound programs of pasture transportation. An expanded version of his ideas appears on page 116.

Nearly every business being sold nearly every industry has a stake in the air transportation industry. Some idea of this may be gained through perusal of the statistical presentation on page 123.

More Wings for Army Airplanes are the result of a unique conveyor system in Bell Aircraft plant. A complete and detailed description of this system, with particular emphasis on the tooling, is given in this new beginning on page 126.

As is customary with the Annual Yearbook, the Short Book of Defense Detail is now in expanded form. Page 147

Coasting

The Month issue of Aviation will include a detailed description of the American methods employed in North America in producing the famed B-25 bombers. Other manufacturing features will concern design and production of the submarine materials at Vickers, use of high frequency electricity for setting joints in plywood construction, and a number of others with particular emphasis on the rapidly expanding plywood trend.



This label is backed by 23 years of aircraft plywood experience!

● Crescent's long specialization in aircraft plywood is speeding production for our customers in these important ways: *Faster output. Most modern equipment and methods. Evident record on delivery. Central location saves shipping time.*

There is no substitute for this real KNOW HOW that Crescent offers the aviation industry—in meeting today's huge warplane program, and in pioneering wood conversion developments for tomorrow's peace-time aircraft!

Completely finished aircraft parts are fabricated by our affiliated company—INDIANA FENNER & PANEL CO., NEW ALBANY, IND.

The **CRESCENT PANEL CO.**
LOUISVILLE, KENTUCKY
One of America's oldest and most progressive aircraft plywood manufacturers



"Eyes of the Artillery" ...PIPER L-4

YOUR CONTACT BY MAIL. Send today for your copy of the new-to-enthusiast booklet, "Now, You, Can Fly!" If you also want the full-color Piper coloring, enclose 50c in stamps or coin for postage handling.

DETERMINATION and TEACHING. Write to us, helpful Teacher's list of Junior Aviation Instruction Manual includes 5 "What Charts" (25¢ a set), Manual Plans Blueprint, Literature. Send \$1.00 or check.

PIPER AIRCRAFT CORPORATION,
DEPARTMENT 225,
LOCK HAVEN, PENN., U.S.A.

THE Piper L-4 plane is already proving its worth as the "Eyes of the Artillery" on the fighting fronts. Called the "Groundsper" by artillerymen, the L-4 does a job greatly superior to the vulnerable observation balloons of the last war... and with relative safety!

The observer radios firing corrections to the battery until the guns are dropping shells directly on the target. The "Groundsper's" protection is low altitude flying, its ability to land quickly almost anywhere, the ease with which it can be hidden and the fact that it is practically invisible from above, even when in flight!

Its uses are not limited to the Artillery. It is now serving Uncle Sam in the Tank Corps, Cavalry and Infantry... directing troop movements, transporting officer personnel, delivering messages and spotting enemy infiltration.

And, when victory is won, you will benefit by a smart, easy-to-fly prototype version of this remarkable plane. You'll be able to make quick, safe, useful flights to your favorite hunting, fishing and vacation spots, and streamline your business trips... saving time, gasoline and tires.



PIPER

POINTS THE WAY TO WINGS FOR ALL AMERICANS



VICTORY IS EVERYBODY'S BUSINESS

This is not just a man's war—winning it is everybody's business. Men and women workers are sharing equally in the responsibility and the credit for the results accomplished in America's war production program.

At Solar Aircraft this sharing of the production burden has contributed much. It has, in a large measure, made it possible for Solar to produce unprecedented numbers of "anti-monoxide" exhaust manifolds for America's fighting airplanes.

SOLAR

EXHAUST SYSTEMS—

SOLAR AIRCRAFT COMPANY • SAN DIEGO, CALIFORNIA



Spreading the Work

MULTIPLIES PRODUCTION MANYFOLD!

Meeting production schedules and delivery dates *exactly on time*, calls for careful, competent planning, for teamwork of the highest order. But it also calls for *capacity*.

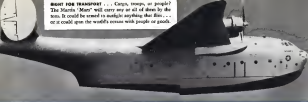
One way to multiply the production of a prime contractor—to effectively increase his capacity—is to *spread the work*. For example, at McDonnell, on one airplane contract alone, 70 percent of the work is spread among 50 subcontractors in 8 neighboring states.

Such an arrangement not only *speeds* production, but also makes possible *expanded* production. That's why at McDonnell, we are not only completing present contracts *on time*—but are also in a position to handle *additional* production contracts.



MCDONNELL AIRCRAFT CORPORATION
SAINT LOUIS

RIGHT FOR TRANSPORT . . . Corps, troops, or just the Marine "Mae" will carry any or all of them by the tons. It could be used to smuggle anything that fits . . . or it could open the world's oceans with people or goods.



RIGHT FOR BOMBING . . . No wonder the Japs and Nobs dread the Martin B-26! Carrying a bombing load at lightning speed, it can give its enemies a hell of a warship's ground support, or an enemy fighter.



...but which is the BEST Airplane?

When you know that Roebling is adding its words to those of others that are living upon solid, explaining to America that there is no best airplane . . . there is only a right airplane for each task that we face. In recent issues of "Time", Roebling advertisements saluted Fairchild and Martin, respectively, for the job they're doing, as we have and will make many aircraft products in turn. Explaining how . . .

FAIRCHILD stands for TRAINING—plus

"You know FAIRCHILD is a builder of the superb Army PT-17 biplane in which thousands of our fighting pilots first go solo for primary flying instruction. The problems of visibility, navigation, safety and dependability that were solved to make this ship a reality are a story in themselves. But there's more in Fairchild than that—"

"Yes, more than just an airplane factory, with the skilled hand of engineering as its life . . . for Fairchild is today's "engineering division" in the whole aircraft industry. Its capabilities are as wide as ours, leaving new power to guiding engines in the atmosphere, new types of aircraft specially designed to meet the needs imposed by total war, new types of aircraft

structures for transport and the utilization of atomic materials. Then Fairchild takes its place as member of those MARINE WE MUST NEVER FORGET . . . brought sharper colors to the birds of war, that the wings of peace may spread sooner."

MARTIN means PIONEERING . . .

"We built her first airplane in 1916. He gave the first U.S. bank loan to an airplane . . . made the first executive ocean flight . . . pioneered, with all of pioneering bank ships, in all metal planes, five bombers, heavy bombers, many others. He gave a Glenn L. Martin . . .

"He told that the U.S. has such men, in field and shop with their capable hands our fighting planes and powerful fighters in the air. Plus who know that there is no best airplane, today, a right airplane for each job . . . and know how to build it."

"And, as you know the increasing number of ships ships taking wing . . . the first B-26, the very first bomber to fly at lightning speed . . . the Martin B-26C Marauder, as ships fast and wide as the fleet . . . the Martin B-26C, in bombs, or tanks, or ships . . . the great "Mae", whose heavily-laden wings can open the globe—mean-

ing, America, that each is superior right for its task today, and yet, has a tomorrow of things to come, when we need, and much of our experts, and our relief for nations abroad, and our trade with Latin America will take to the top of the sky."



And a word about the faithful "Kee-String" that means Control . . .

You know by now that an airplane is just a piece of wood, held aloft against a hurricane of its own making. What a job for a kee-string . . . the only one, steady strong control cable we make here at Roebling! Miles and miles of this steel "kee-string" are building Allied bombers "on sugar", increasing Allied fighters' guns on Mark XXIV and red "Aunt". We make it as they won't miss.

JOHN A. ROEBLING'S SONS COMPANY
PROVIDENCE, NEW JERSEY
Brooklyn and Weymouth in Principal Cities

RIGHT FOR PILOT TRAINING . . . Fairchild's PT-17 is built to "take it" . . . in thousands of engine planes from the right and wrong way to land. High climbing, good visibility, and excellent maneuverability are other characteristics . . .



RIGHT FOR PATROL . . . The Marine "Marauder" ranges the world's sea lanes with the fleet, its living quarters, galley, and men keeping its crew in top fighting shape boat after boat.



RIGHT FOR BOMBING TRAINING . . . Fairchild's versatile money model plywood biplane, the AT-16, teaches the spot where around pilots, navigators, radio men, bomb loaders and gunners learn to work as a team.



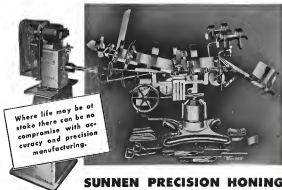
Salute to the JOB THEY'RE DOING!



ARMY	BOWLES	CULVER	ELITCHER	GEORGE	HOBBS	HUGHES	VISA
ARM CRUISE	BRUNER	CARROLL	POPE	HOWARD	NEW	ELAN	HUGHES
ROBIN	CELANA	CELANA	GENERAL	INTERSTATE	AMERICAN	STERNMAN	SEKOR
ROB	COLEMAN	★MARTIN	U.S. AIRCRAFT	ROEBLING	PIPER	TRUBROCK	WATSON
ROBIN	CONSOLIDATED	ELITCHER	GEORGE	★MARTIN	REAR	TEAN	NACD

ROEBLING means

Control in the Air!



SUNNEN PRECISION HONING assures accurate, dependable operation of Wocher Major Operating Table



Hydraulic cylinder and valves for Wocher Major



Steel roller ball bearing. Carburized for accuracy. Used in Wocher Major



Steel roller ball bearing. Carburized for accuracy. Used in Wocher Major



Steel roller ball bearing. Carburized for accuracy. Used in Wocher Major



Steel roller ball bearing. Carburized for accuracy. Used in Wocher Major



Steel roller ball bearing. Carburized for accuracy. Used in Wocher Major



Steel roller ball bearing. Carburized for accuracy. Used in Wocher Major

The hydraulic cylinder and valves of this famous operating table used by the Army and Navy are precision honed by the Sunnen method to obtain accurate, dependable performance. This is just one more example of the hundreds of ways in which the Sunnen "MA" Precision Hone is serving industry in our all-out war effort.

Put Sunnen Honing to Work in Your Plant

The "MA" is fast! Its economy conserves vital war materials, assures absolute interchangeability of parts, low in cost, economical to operate.



Sunnen Awarded Army-Navy "D"
for its production of honing equipment being used throughout industry in the manufacture of vital war materials.

SUNNEN

SUNNEN PRODUCTS COMPANY, 7942 Manchester Avenue, St. Louis, Missouri
Canadian Factory: Chatham, Ontario

Wide Range—handles any internal diameter from .183" to 2.400".

Easy To Operate—workmen in "teens"—even girls—can be trained to handle jobs in "teens" in a few hours.

No Fixtures Needed—work held in hands. Eliminates big internal fixtures for other jobs.

Let a Sunnen Engineer Check Your Job!

We'll gladly have a field engineer check your grinding or honing job in your plant with our "MA." Or write for free literature giving complete information.



*The glimmer from Arcturus
may set Japan afire!*

SOME NIGHT an armada of planes will ride the cushion of clouds that conceals the land of Nippon down below. Coated in the patch of light that boys across their tables, the navigators of this armada will trace a line on a map, and through an Auto Compass they will "shoot the stars"—perhaps Arcturus—for their position and their course. And then the stars will say, "Tokyo here!"

This is now happening nightly all over the world. No need to fix the landmarks. No need to guess the tricks of camouflage, because there are instruments that take direction from the signposts that are forever fixed. The stars.

These instruments... the Auto Compass that says, "You are here, and the enemy objective is there!"... may be very true, very precise, very reliable. They are all of that...

almost as true, as precise, and as reliable as the very stars from which they take instructions.

The Auto Compass among the factories and navigational instruments which we are producing for wartime success. These products, being produced in quantity, require skill, care and precision in the making. Every effort is made to bring these qualities into play, and there is evidence that the enemy is well acquainted with their facts.



The H.R. **BOES** *Company, Dayton, Ohio*

MANUFACTURERS OF ELECTRICAL AND MECHANICAL INSTRUMENTS FOR AIRCRAFT
A GOAL TO BEAT! Our employees voluntarily accept 10% of their earnings—\$5.00 out of every \$50.00—in War Bonds. We would like to increase in future months the square of other companies in the aircraft industry that are resulting in recording that mark. May we hear from you?



NH-1
FOR THE NAVY
(Now in Production)

"RULE THE SEA IN '43—FROM THE AIR"

PT-23

FOR THE
ARMY AIR FORCES
(Now in Production)



BLANCHARD

CHECK THESE
ADVANTAGES
OF BLANCHARD
GRINDING

- ★ Production
- ★ Adaptability
- ★ Fixture Saving
- ★ Operation Saving
- ★ Material Saving
- ★ Fine Finish
- ★ Flatness
- ★ Close Limits

★ . . . Especially
valuable on jobs like
the one illustrated.

"PUT IT ON THE BLANCHARD"

+ .0003" - .0001"
WITH VERY FINE FINISH

No. 18 Blanchard grinding oil pump bodies.

Group of oil pump body parts—all ground on No. 18 Blanchard.



PRODUCTION INCREASED 71 PER CENT

BOTH roughing and finishing are done by the same No. 18 Grinder on these oil burner pump parts. First ground from the rough, then rescheduled and ground again, the parts are then ready for boring and drilling, locating from the flat Blanchard Ground surfaces. After all machining is done the parts are finish ground on the Blanchard to limits of $\pm .0003" - .0001"$ and to a very fine finish. The pump body must have its end square with a finished face. Twelve are held at one time on fixtures mounted on one base plate, and magnetically held. It only takes a few minutes to remove the group of fixtures, leaving the chuck clear for other work.

Blanchard cylinder grinding wheels, manufactured by the Blanchard Machine Company, are used on this job. This was another reason for being able to increase the production from 28 to 48 pieces per hour.



Send for our free copy of "Work Done on the Blanchard". This book shows over 100 actual jobs where the Blanchard has made it possible to increase production.

The BLANCHARD MACHINE COMPANY
64 STATE STREET, CAMBRIDGE, MASS.

23 YEARS AGO FIRESTONE PIONEERED "SHIP BY TRUCK"

Today Firestone PIONEERS "SHIP BY AIR"



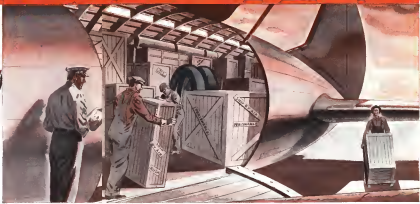
TODAY... IN WARTIME

TODAY American fighting men are stationed from Iceland to Australia, from the Aleutians to the Congo. With them, they have brought American equipment, American standards of living and American spirit. As a result, when peace comes, there will be a world-wide demand for American goods.

To the seaways, railways and highways will be added a fourth dimension in

transportation — the skyways. By ship, by train, by truck, by plane the products of American Industry and American Agriculture will pour forth to every corner of the earth. In this expanded world traffic, each type of transportation will have its place. And each will continue to rely on Firestone, as it has in the past, for much of its equipment.

For example, giant air freighters will fly



TOMORROW... IN PEACETIME

on wings built by Firestone, land on tires, wheels and brakes by Firestone, require many other products of the Firestone plants for safe and dependable operation.

Whenever speed is the prime consideration, goods will be shipped by air. And, as you would expect, Firestone is pioneering "Ship by Air" — just as Firestone has throughout the years pioneered so many other notable advancements in transportation.



Firestone was the first company in the rubber industry to win the coveted Army-Navy "E" Award for high achievement in the production of war materials.

Listen to the Voice of Firestone with Richard Crooks, Margaret Smith and the Firestone Symphony Orchestra, under the direction of Alfred Wallenstein, Monday evenings, over N. B. C.

Copyright 1943 The Firestone Tire & Rubber Co.

THE FOURTH DIMENSION IN TRANSPORTATION ★ ★

the Tank took a hint from



the Duplicating Machine



There's no maintenance man in most offices, making regular trips with a grease gun to see that bearings have plenty of lubrication. That's one of the reasons why builders of business machines selected the Torrington Needle Bearing to lengthen the service life of their products.

With Army tanks, of course, it's entirely different. They're regularly and thoroughly inspected by highly skilled maintenance crews. But when a tank comes back from the battlefield, and the crew starts racing against time to get it ready for another lightning dash

against the enemy, there's a big advantage in having bearings that require no attention. So the tank designers, like the business machine builders, turned to the Torrington Needle Bearing because its high load capacity helps prevent overloading or breakdown, because its single, effective system of lubrication allows the bearing to run for long periods without any attention at all. And its ready availability helps speed the job of tank production.

WHEN YOU PLAN YOUR POSTWAR DESIGN, here's something to think about. Your present customers will probably

be looking for products that last longer, and run smoother, work more efficiently—and the Needle Bearing can help you give them what they want. You will find a long list of typical Needle Bearing applications in Catalog No. 114. One of them may give you an idea for your new product—and Torrington engineers will be glad to help you work out the details.

THE TORRINGTON COMPANY
Established 1898 • Torrington, Connecticut, U. S. A.

Sales in U. S. and Foreign Offices:
New York, Boston, Philadelphia, Newark,
Cleveland, Seattle, Chicago, San Francisco,
Los Angeles, Toronto, London, England.



TORRINGTON NEEDLE BEARINGS

KEYED TO TODAY'S NEEDS

AND TOMORROW'S THINGS



The giant telescope and the aircraft engine—both are precision instruments to conquer space. The telescope merely shortens visual distance, but the twofold power of the aircraft engine telescopes time as well as physical distance to broaden man's sphere of action. For the great transports which speed the ever increasing tonnage of the air, Wright provides the power.

WRIGHT Aircraft Engines

POWER THE TONNAGE OF THE AIR

Simple guard for power drills improves operation



Information supplied by an Industrial Publication

Safety in small things as well as great is an excellent policy for manufacturing plants today. Adding safety devices to small power driven hand tools has the same results as the same procedure on heavier machines. Operators can work better because their attention is undivided.

That was the idea behind a guard for power driven hand drills devised by a worker in an airplane factory. He noticed that hole apertures sometimes got punched square when the drill suddenly punched through the work.

The guard is very simple. It consists of a steel sleeve set into the drill chuck surrounding the shank of the drill bit. It is easy to attach, and it could be made from scrap tubing, or bar stock cut off with a minimum of machining.

In operation, when the drill goes through, the guard brings up against the work, and stops forward motion of the tool. It is long enough so that the operator's fingers cannot be caught between the work and the drill body. As a result slanting down, caused by the operator's natural tendency to flinch is eliminated.

CLIMAX FURNISHES AUTHENTICATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS. MOLYBDIC OXIDE BRIGUETTE + FREEMOLYBOTHORIUM + "CALCIUM MOLYBDATE"

Climax Molybdenum Company
500 Fifth Avenue • New York City



He can take chances—BUT YOU CAN'T

Equipment for war implements has a man-size job to do. The happy abandon of childhood and the mature fruits of liberty and individual initiative are worth fighting for. FLEX-O-TUBE continues to supply the very best hose assemblies observable so that under the pressure and strain, heat and cold, twisting and vibrations of battle duty, military machines will not fail nor fail our men. With the firm belief that there is nothing too good for our fighting men and for those for whom they are fighting, FLEX-O-TUBE redoubles its efforts to help finish the job.

Standard sizes and types to suit every installation. More applications with fewer parts. Easy setting, control and maintenance. All based on years of experience and development in flexible hose assemblies for aircraft, automotive, marine and machine tool applications. For complete information, consult nearest office.

★ the **FLEX-O-TUBE** Company

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501 Fifth Avenue, New York
215 West 7th St., Los Angeles
7 Yonge St., Toronto, Ont., Can.

A message to men who say "A Bellows Won't Do!"

COOK "Spring-Life" BELLOWS offer many surprising advantages for service beyond the scope of ordinary bellows

Characteristics of Cook "Spring-Life" Bellows

Examined and described below are some of the characteristics and distinctive advantages of the Cook "Spring-Life" bellows construction. They are as follows:

Dependability

From fabrication to the end of its useful life, the Cook "Spring-Life" bellows is a dependably reliable device. The reason for this is its ability to resist fatigue, corrosion, and wear. The design of the bellows is such that it will last for the life of the machine, and the material is of the highest quality.

Long-Service

The construction of the bellows is such that it will last for the life of the machine, and the material is of the highest quality. The design of the bellows is such that it will last for the life of the machine, and the material is of the highest quality.

Resistance to Corrosion

Corrosion of the bellows is a serious problem in many industries. The Cook "Spring-Life" bellows is made of a material that is resistant to corrosion. The design of the bellows is such that it will last for the life of the machine, and the material is of the highest quality.

Sensitive Low-Pressure Response

The Cook "Spring-Life" bellows is a sensitive device. It will respond to the slightest change in pressure. The design of the bellows is such that it will last for the life of the machine, and the material is of the highest quality.

Uniform Pressure-movement Ratio

The Cook "Spring-Life" bellows is a uniform device. It will move in a uniform manner. The design of the bellows is such that it will last for the life of the machine, and the material is of the highest quality.



Upper—4" W. Low Pressure Bellows

Right—10" W. High Pressure Bellows
Serving Hot Plate



The design, the development, and the construction of the Cook "Spring-Life" bellows is a direct result of the company's ability to find a bellows on the open market that would meet our own requirements.

After making laboratory tests, after long and proved service in our own production, after superlative performance in the most severe types of service—we are now ready to devote, engineer and supply the Cook "Spring-Life" bellows to those segments of industry which require a standard of performance in the larger class, not ordinarily available in bellows.



Here Is the Toughest Job Any Bellows Can Be Asked To Do

Here is a degenerative view of the Cook "Spring-Life" bellows as used in a Water Hammer device. No ordinary bellows could withstand the terrific shock, the violent and sudden compression which takes place in the system.

In this application, the Cook "Spring-Life" bellows is subjected to the most severe and punishing service and conditions in the industry. It is subjected to the most severe and punishing service and conditions in the industry.

Here Are Two Widely Different Applications

Cook "Spring-Life" bellows, as illustrated in the above, are used in the most severe and punishing service and conditions in the industry. They are used in the most severe and punishing service and conditions in the industry.

The Cook "Spring-Life" bellows is different in principle, different in design, different in material employed, different in the type of service in which used.

These bellows are not "crushed" together—they are formed and assembled. The patented design is such that its serviceability is limited only by the fatigue point of the metal employed. These bellows are required in the most severe types of service, and because of this, they withstand terrific shocks without losing their "Spring-Life". Consequently, they can be built in much larger diameters and lengths than any other bellows made of high tensile metals with a slow fatigue point.

The performance of the bellows is such that it will last for the life of the machine, and the material is of the highest quality. The design of the bellows is such that it will last for the life of the machine, and the material is of the highest quality.



How can the Cook "Spring-Life" Bellows help me?

Here is a new book just off the press that contains the complete story of the Cook "Spring-Life" bellows. It tells you the story of the bellows, its history, its development, its construction, its serviceability, its advantages, its disadvantages, its uses, its applications, its history, its development, its construction, its serviceability, its advantages, its disadvantages, its uses, its applications.

THIS BOOK
GIVES YOU
THE ANSWER

Send for it



This is the "Spring-Life" Principle . . .

The "Spring-Life" principle employs a method of construction in which the bellows is formed in a single piece of metal. The bellows is formed in a single piece of metal. The bellows is formed in a single piece of metal. The bellows is formed in a single piece of metal.

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COOK ELECTRIC COMPANY
2700 SOUTHPORT AVE., CHICAGO, ILL.

A new name* in America's warplane production

"Trigger planes"—that's what our pilots call the fighter planes and bombers that are ready for front line action.

But not many of America's mass-produced ships are "trigger planes" as they roll from the assembly lines. So rapid are the changes in tactics and developments in aerial warfare that some features of these planes are rendered obsolete before they leave their factories.

The Army Air Corps' answer to the problem of keeping our planes superior to the enemy's, without delaying production, has been the creation of modification centers. Here the latest combat experience and newest discoveries are incorporated into our war planes to make them the "fighting" ships in the air.

Down in Birmingham, Alabama, we are completing and placing into operation one of the most ad-

vanced modification centers yet established in the United States. In this plant, designed and built



by us, huge B-24 Liberator bombers are being given their final grooming for front line service. They are being prepared

for assignments in North Africa... Europe... the Middle East... India... China... the South Pacific... the Aleutians... for every part of the world... and for the specific climatic and tactical conditions under which they will be flown.

They are "trigger planes" in every sense of the word when they leave our plant, battle-bound. Armed to the teeth, guns warmed, they are ready to meet enemy fighter planes the moment their wheels lift from our runway.

* Bechtel-McCone-Parsons Corporation is a new name in the aircraft industry, but the members of our highly experienced organization are old hands at engineering, constructing and operating industrial enterprises, and in undertaking difficult and challenging projects.

ASSOCIATE DIRECTOR
BECHTEL-MCCONE-PARSONS CORPORATION



Only One Objective-VICTORY!



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Help to Keep 'em Flying

Since the beginning of modern aviation Wittek has been a producer of hose clamps for that industry. Today—Wittek Aviation Hose Clamps, known as the standard of the industry for dependable hose connections, are being used by the outstanding military aircraft and engine builders. Wittek Manufacturing Co., 4395-15 West 24th Place, Chicago.



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BECHTEL-MCCONE-PARSONS CORPORATION ENGINEERS-CONSTRUCTORS

601 West Fifth Street, Los Angeles • 220 Montgomery Street, San Francisco

AVIATION, February, 1943

AVIATION, February, 1943

**Puts
MORE BOMBS
ON THE TARGET**



HERE is another answer to Axis aggression, given in the only language the Axis rulers understand — more weapons — better, harder hitting! The new Curtiss Hallibury is reported to be capable of carrying a heavier bomb load better and faster than any dive bomber in service. It is known as the "world's deadliest dive bomber."

American engineering genius, in developing a steadily increasing use of light-weight aluminum and magnesium in American planes and engines, is contributing greatly to the record our air forces are establishing in carrying the fight to the Axis.

And Aluminum Industries men and women are proud to work unceasingly to that Permitte Aluminum and Magnesium Alloy Castings may go in ever-increasing volume into planes and engines of many types to help bring nearer the Day of Victory.

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AVIATION, February, 1943



Making America's fire-power **"FAST ON ITS FEET!"**

War takes more than man-power and fire-power today. It takes *horse-power*, by the billion! All kinds of horse-power! Some for lightning speed—some for sheer irresistible "oomph"—some for steady, hour-in-and-hour-out pulling at full load.

In bomber and fighter plane engines, in army trucks, tractors, tanks, jeeps, motorcycles, in submarines, torpedo boats and destroyers, Sealed Power Piston Rings are saving fuel and oil that become precious beyond price, after being earned perhaps half-way 'round the world.



SEALED POWER CORPORATION

Detroit, Michigan • Windsor, Ontario

**BUY
MORE
WAR
BONDS**

PISTON RINGS — PISTONS — CYLINDER SLEEVES

AVIATION February, 1943

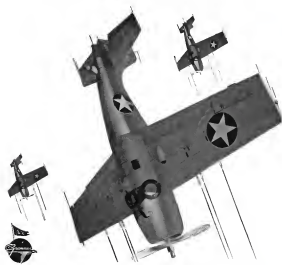
Zero hour for ZEROS

Off heaving flight decks and bomb-scarred fields, from Wake to Guadalcanal... United States Navy and Marine pilots in Grumman Wildcats are fighting through hostile skies to victory.

It's just too bad for Tojo when one of our lads gets a head on a Zero. American courage, American skill plus a ship like the Wildcat is more than a match for the best the Jap has to offer!

Years of experience designing and building planes for specific services give Grumman aircraft what it takes to come through. For war today... and peace tomorrow... look to Grumman to set the pace.

GRUMMAN * * * * *
MAKES PLANE THAT MAKE HISTORY



- * AUTOMATIC PHOTO, DIRECTION FINDER, DIST. INDICATORS
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- * COIL MOTORS, AMMUNITION BOXES AND CRATES
- * TONGS, DIES, BEG AND PISTONS — TOOL DESIGNERS
- * WELDED ASSEMBLIES — GAS, ARC AND SPOT
- * ENGINE COVERS, SPEED-REDUC. MACHINES, EXHAUST COLLECTOR RINGS AND EXHAUST MANIFOLDS
- * WING PANELS, TAIL EMPENNAGES, STRUTS AND MAJOR AIRCRAFT ASSEMBLIES
- * AIRCRAFT PARTS
- * A-N STANDARD FITTINGS
- * AUTOMATIC SCREW MACHINE PRODUCTS

HARVEY PRODUCTS HELP

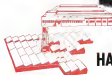
Sight 'em and Gook 'em!

Our fighting men find the enemy first with the help of Harvey electronic equipment. Just then out in planes, tanks and ships the Harvey company helped build — and sink 'em — hand in with equipment produced in the modern Harvey plants.

Now, the various divisions of the Harvey Machine Company are delivering vital war equipment of widely different types to the United Nations fighting forces in every corner of the world. To meet the faster delivery rates demanded for our equipment, production has been stepped-up many times — faster than is the average for all industry.

Today every man and machine in the huge Harvey plant is working at top speed to supply and equip our Armed Forces... but we invite inquiries on any products present or present that will help win this war.

Plans are already made by which Harvey developments will become outstanding contributions to commercial aviation — when the war is won. Developments now in military use, and others not yet announced, will make flying still safer, faster, and more efficient — in years to come.



HARVEY MACHINE CO., INC.

"for three decades serving America"

LOS ANGELES

CALIFORNIA



THE GOVERNMENT

OF THE PEOPLE, OF THE PEOPLE, FOR THE PEOPLE SHALL NOT PERISH FROM THE EARTH"

Giving Wings TO LINCOLN'S WORDS

SPARTAN SCHOOL OF AERONAUTICS

This "University of Aviation" sponsored as a division of the Spartan Aircraft Company is doing one of the greatest training jobs in history of any American civil aviation school. Mailed aircraft technicians by the thousands have gone out from Spartan School to serve the industry. Other thousands are now being trained to meet the ever-growing need. Spartan School and its graduates gladly serve as flying America.

Slugging down through the years, the inspiration of Lincoln's words is today called upon as never before to inspire upon every American the need for a supreme war effort . . . that government of the people, by the people, for the people shall not perish from the earth."

Today, a breed of American eagles are giving wings to these words . . . are soaring aloft from air fields in many parts of the world to justify and righteously protect our inalienable rights of life, liberty and the pursuit of happiness. Spartan counts it a privilege to help supply these gallant fighters with the vital equipment needed for the sure victory that lies ahead.

As a member of the world's greatest aircraft industry, we do today's urgent task with complete confidence that this action shall continue to endure . . . a free nation!

SPARTAN

AIRCRAFT COMPANY



TULSA, OKLAHOMA

**YOUNG MEN
16 and 17
YEARS
OF AGE *****

**The War Need Not
Prevent Your
Enjoying a Great
Lifetime Career
☆☆☆**



AFTER high school . . . what? Does your friend advise you a future career seems impossible? Later . . . one of the greatest opportunities for a real lifetime career is one of the most important industries the world has ever known awaits young men of 16 and 17 years of age who are now!

Will History Cank You Supremacy?—America is going to win this war . . . and America is going to be the world leader in the dynamic aviation industry that is sure to follow the war. Men who have had special last training in any of the various branches of aviation can be accepted to any one of the important positions in this great commercial aviation industry abroad. On the ground and in the air, with the entire money-making and manufacturing, most excellent opportunities will be available for those who are ready. In the meantime you will be training to become a skilled operator, mechanic (and you will be doing something when and if you are called to military service).

SPARTAN School offers you the opportunity now to acquire your education in a dynamic career that can be both informal and practical. Incorporated in the outstanding, old-fashioned aviation training school in America, SPARTAN provides superior specialized training to any branch of aviation you choose. You're just the right age to get a head start on the world of aviation. But you should not sit and wait until the regular line opens. Start your career now! Mark 355.

Spartan Automobiles—Spartan Government Approved Aircraft or Engine Mechanics Course is now open in 12 weeks and Air Mail Technician (AMT) Course is open 48 weeks to five with various payment plans. All of the civil aviation schools in the country a greater number of licensed mechanics in the aviation industry. Write for details.

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SPARTAN is a genuine "University of Aviation", where the highest standards of educational training are maintained. 12 modern buildings housing an 12 acres—completely equipped laboratories and shops—a fleet of training planes valued at \$250,000—serve flying trainees—Government Approved and top rated in the industry. The Spartan catalog will tell and show you all the following facts:

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Address _____ City _____
State _____ Zip _____
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WHERE
CYCLONES
ROLL DOWN
THE LINE...



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For installations, as specified, on removable parts of planes—Gas Tanks, Seats, Cowlings, Landing Gears, Wiring Assemblies.

The T & B Disconnect Bonding Jumper is designed to let go in line of pull at approximately 15 pounds. It is particularly helpful on Auxiliary Gas Tanks on long range planes. The Tanks are automatically dropped when empty and the Jumper automatically disconnects. Also on Emergency Doors and Exits, the Jumper lets go when the door is kicked open.

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Dunco Avialite-Relays receive automatic reinforcement in relays to meet military requirements in industrial types. They meet problems in

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DUNCO DISTRICT ENGINEERS IN 28 CITIES WILL HELP SOLVE YOUR RELAY-TIMER PROBLEMS

AVIATION, February, 1943

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True sense of defense is shown with a designer who would do good would come of "being mediocre." But, in spite of their doubts, men talented, daring and distinguished over the air. Success came because they were never content with gross copies of aviation, details in network of construction.

Light-weight plastics have maintained a share in the perfection that has reached. And, among these plastics, Synthane is one which has been successfully used.

Synthane Bakelite-laminated is a three-surface plastic with many properties desirable in low cost primary and secondary aircraft parts. Chief among these properties are light weight (half the weight of a laminated) resistance to corrosion from even sea salt and gasoline, water and easy work, structural strength, resistance to change in shape with change in temperature, excellent electrical insulating characteristics, and ease of machining.

SYNTHANE CORPORATION, GAKS, PA.



FIRST OFFICIAL TRANS-ATLANTIC JET MAIL flight with General Post Office from New York to France. The "America", plane, in its capacity at General Post Office, L. I., just before taking off, June 28, 1932. Aero Digest photo.



TUNING UP ARMY'S FIEB PLANE. Military airplane shown in America at the Army Air Corps in first place, captured from the Wright Brothers in 1908. Official Photograph, U. S. Army Air Corps.



EARLY WING-HEATING SYSTEM ready for trials on the Argentine, Brazil, Florida. Photo shows the system's test, wings and fuel elements and a rubber which was added to give stability. Photograph courtesy Aero Digest.



THE AVIATION INDUSTRY
OK'S SYNTHANE
Bakelite-laminated for

- LIGHT WEIGHT with Structural Strength
- LIGHT WEIGHT with Corrosion Resistance
- LIGHT WEIGHT with High Dielectric Strength
- LIGHT WEIGHT with Ease of Machining

SYNTHANE
Bakelite-laminated

SYNTHANE TECHNICAL PLASTICS

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WITH HITLER!**



PATTERNS FOR DOING BUSINESS WITH THE AXIS



Who says "You Can't Do Business With Hitler"? Douglas A-20 Havoc and B-26 Invader bombers, Douglas Skyraider, Skytrons and Skytrooper transports are doing business with Hitler around the clock. It's a grim business that will increase in volume until our final victory is won. Douglas Aircraft Co. Inc., Santa Monica, Calif. World's largest builder of cargo and transport airplanes.

DOUGLAS

MEMBER, AIRCRAFT WAR PRODUCTION COUNCIL, INC.

More Power per Pound



HANDLE

Steel pin works as tie
rod between gears in
housing, makes snap-in
operation.

HELD HOUSING

Steel inserts for housing
assembly screw and into
gears for permanency.
Steel connector and
bearing ball and the
housing also serve as
general connector for shaft.

GEAR CASE COVER

Steel bearing
inserts retained in
cover are per-
manently fast to
plastic to avoid
bearing stress.

GEAR CASE

Steel shafts bearing
inserts and steel
bearing balls bearing
inserts permanently
fast to plastic
housing.

**in the New Black & Decker
"Drillite" Plastic Drill**

BLACK & DECKER Engineers have done it again! A husky, new, lightweight drill with the highest horsepower per pound of any drill ever produced by Black & Decker. The housings of these $\frac{1}{2}$ " Standard and $\frac{3}{8}$ " Standard Drills—made from the modern new plastic... **DRILLITE**—were exclusively developed and perfected by eye-to-the-future Black & Decker Engineers. **DRILLITE PLASTIC** makes these tools a full pound lighter in weight—yet exhaustive tests prove

they stand up under hard, continuous straining.

DRILLITE is a perfect insulator against dielectric shock, makes the drill cooler to handle, has high impact resistance. Swept-out air vents insure ample ventilation. Hardworn black finish provides lustrous, modern streamlined appearance.

Ask your nearby Black & Decker Distributor for complete specifications on the Electric Drills of Tomorrow! The Black & Decker Mfg. Co., 735 Penna Ave., Towson, Md.



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Black & Decker
PORTABLE ELECTRIC TOOLS



$\frac{1}{2}$ " STANDARD DRILL with 100 Speeds Weight... 4 1/2 lbs.

$\frac{1}{2}$ " STANDARD DRILL with 100 Speeds Weight... 4 1/2 lbs.

$\frac{1}{2}$ " STANDARD DRILL with 100 Speeds Weight... 4 1/2 lbs.

$\frac{1}{2}$ " STANDARD DRILL with 100 Speeds Weight... 4 1/2 lbs.

The plane that caught the Axis *flat footed!*



NORTH AMERICAN'S P-51 MUSTANG

THE Mustang is one of the finest performing fighter planes ever built for low altitudes. It has plenty of speed, is highly maneuverable and packs a healthy wallop. Even the British have lavished praise for this American plane.

The Germans had just brought out their new Focke-Wulf 190, a high altitude fighter, when the low-flying Mustang hit the scene. At low altitudes the Focke-Wulf could not match the flying performance of the Mustang—and neither could any other German fighter.

Part of the Mustang's performance is obtained by use of SIREX

Seamless Steel Aircraft Tubing—the strongest structural form known for its weight. All excess weight is eliminated from vital parts of landing and landing gear.

Plants of NATIONAL Tube Company are turning out SIREX Aircraft Tubing in ever-increasing amounts to meet the new production schedules. All types and sizes are made in accordance with rigid government specifications.

Write for our new book on aircraft tubing giving complete details on types of steel, surface finishes, special shapes and many helpful tables that will save you time and effort.



SMOOTH SEAMLESS AIRCRAFT TUBING is available in all standard sizes and sections, made to exacting government specifications. It is the most common structural material for the world's largest manufacturers of military products.

NATIONAL TUBE COMPANY
PITTSBURGH, PA.

Atlantic Dist. Offices, San Francisco, Pacific Coast Branches

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UNITED STATES STEEL



ETHOCEL

—shock resistance at zero

Continued progress in the development of plastic materials has made possible many difficult military and industrial applications. Typical result of Dow's long-term research program is a new type of Ethocel Plastic made of Dow ethyleneimine but is proving a valuable contribution to the war effort. This material possesses remarkable toughness and shock

resistance at temperatures of zero and below to -70°F .

Ethocel is equally durable over a wide range of atmospheric conditions and has exceptional lightness and strength. This unusual combination of properties makes it adaptable to a wide variety of uses formerly considered too severe for plastic materials.

COSTON TUBES

Carbon tubes, used on life raft buoys, are typical of the applications using Ethocel properties to advantage. These tough, shock-resistant plastic tubes house the buoys' batteries. The tubes must withstand the heavy impact suffered when life rafts are thrown overboard in heavy weather.

THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN
New York • St. Louis • Chicago • Boston • San Francisco • Los Angeles • Seattle

PLASTICS

STYRON

SARAN

ETHOCEL



CHEMICALS INDISPENSABLE
TO INDUSTRY AND VICTORY

SCHATZ

Precision
AIRCRAFT
BALL BEARINGS

SCHATZ AIRCRAFT CONTROL BEARINGS
UPHOLD THEIR REPUTATION
FOR
PRECISION PERFORMANCE
IN
AMERICAN FIGHTING SHIPS
THE WORLD OVER

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STANDARD PRODUCTS
Standard for the Industry

Dependable CONTROLS

FUEL PRESSURE
OIL DILUTION and PRIMER

These precision controls, as well as other Standard instruments, are being specified for, and are proving their dependability daily in the military aircraft of the United Nations. Write or wire for complete engineering details.



OIL DILUTION VALVE

This valve is an electrically-actuated valve designed primarily for the dilution of engine oil with gasoline to facilitate easy starting in cold climates, but may be used in conjunction with any necessary restriction in accordance with any voltage drop. It can be furnished for any voltage. Weight, 10 1/2 lbs. at Overall dimensions, 5-1/4" diam. x 2 3/4" long.

FUEL TANK PRESSURE CONTROL VALVE

This Standard Valve prevents vapor lock by maintaining the correct pressure in the fuel tank for all flight conditions. It is constructed of solid sections for maximum fuel pressure and safety release for any tank pressure. Weight, 1 lb. 2 oz. at Overall dimensions, 4 1/2" x 2 1/2".



STANDARD



STANDARD AIRCRAFT PRODUCTS, INC.
DAYTON, OHIO

EASTERN SALES OFFICE — General Aircraft Products, 1813 Graybar Bldg., New York City
WESTERN SALES OFFICE — Western Aviation Supply Co., 2417 Cranston Bldg., Los Angeles, Calif.

AMERICA'S ONLY
RADIAL AIR-COOLED
DIESEL ENGINE



SAFE LIGHT WEIGHT DIESEL

POWER

FOR TANKS • FOR PLANES • FOR SHIPS

Using fuel that will not burn even when exposed to open flame, the Guiberson completely eliminates the usual fire hazard from the power plants of tanks, planes and ships, and there is no ignition system to cause sparks or interfere with radio operation. Weighing less than two pounds per horsepower, the new light weight Guiberson diesel hits harder, faster, farther. Safe and dependable, Guiberson powered equipment is hitting the Axis on the battle lines of the world and is ready to serve on land, sea and in the air.

Guiberson U.S.A.



GUIBERSON DIESEL ENGINE COMPANY
Dallas, Texas

THE GUIBERSON CORPORATION
Aircraft and Marine Divisions



Unfair to Gremlins!

NO HAPPY HUNTING GROUND for Gremlins is there ADEL-equipped fighting planes serving the United Nations' Air Forces. These pesky little spirits who, as everyone knows, are responsible for faulty flying. But ADEL aircraft equipment just about Gremlins-proof.

ADEL hydraulic control valves never jam in spite of Gremlins.

ADEL clips and knobs protecting vital life lines against winter frost remain clean and strong, refusing to transmit Gremlin stink bombs.

ADEL anti-icing pumps insure ice-free carburetors, propellers and windshields in all altitudes and weather.

The secret of foiling Gremlins? Design simplicity plus maintenance standardization. For complete information, contact nearest engineering service office.



ADEL Valve "V" Remains free of all values of jamming operation in carburetors, propellers, etc.



ADEL clips and knobs keep vital life lines clean and strong. They refuse to transmit Gremlin stink bombs.



ADEL Anti-icing pumps insure ice-free carburetors, propellers, and windshields in all altitudes and weather.

ADEL

PRECISION PRODUCTS CORP., BURBANK, CALIFORNIA

Engineering Service Offices: DALLAS, TEXAS • DETROIT, MICH. • HUNTINGTON, W. VA. • HARRISTOWN, MD. • TORONTO, CANADA

New STAMPING TRIMMERS

Stop Bottlenecks • Do the Impossible

in War Production Plants



New, compact, and simplified parts—required by new aircraft designs and other special war equipment—are being trimmed, formed, or built on Quickwork Whiting Stamping Trimmers. In many instances, these Quickwork machines take out to seconds operations

that were formerly done by slow, inaccurate methods.

If you have stampings of any kind—metallic, ductile, or other alloy—of any shape, investigate Quickwork Whiting Stamping Trimmers. By reducing process and operations, and speeding up trimming or forming operations, they can break production bottlenecks in your plant.



The Quickwork Whiting No. 8 Stamp Shear is widely used for trimming special stampings—in any piece—such as those shown here. Once, accurate edges are cut in a single pass.



Other Quickwork TIME SAVING Metal Working Machines

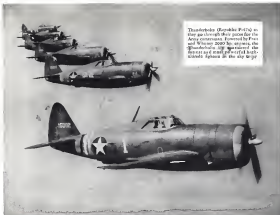
SOCKET SQUARES
—available in a wide range of sizes in one piece and plan up to 1/2 inch. They are built of steel, brass, and copper.

POWER HAMMERS
—operate on compressed air, electric, or hand power. Some of them are controlled without contact operation. Available in five sizes.

"QUICKWORK" WHITING

Division of Whiting Corporation, 15623 Lathrop Ave., Harvey, Illinois

The Aviation Industry Is Served by Whiting Corporation with Trucks • Tools • and Matched Maintenance and Handling Equipment



Thunderbolt (Republic P-47) as they go through their paces for the Army command. Powered by Pratt and Whitney 2000 hp engines, the Thunderbolt is equipped with the most and most powerful high-speed engine in the sky today.

HIGH-FLYING WAR "BIRDS" require Dependable Lubricants

THAT'S why so many military and naval aircraft are lubricated with Texaco Aircraft Engine Oil . . . why more service aircraft units in the U. S. are flown with Texaco than with any other brand. Consistent use of Texaco Aircraft Engine Oil means more engines, less repairs and rubbers, minimum bearing and cylinder wear. The outstanding performance that has made Texaco FIRST with the airman has made it FIRST in the fields listed in the panel.

Texaco users enjoy many benefits that can also be yours. A Texaco Aviation Engineer will gladly cooperate in the selection of Texaco Aviation Products, available at leading airports in the 48 States.

Please the nearest of more than 2500 Texaco distributing points, or write to The Texas Company, Aviation Division, 435 East 42nd Street, New York, N. Y.

THEY PREFER TEXACO

- Most biplanes, many low flies and more biplanes are lubricated with Texaco than with any other brand.
- Many outstanding Naval biplanes in the U. S. are lubricated with Texaco than with any other brand.
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- Many biplanes in the U. S. are flown with Texaco than with any other brand.



TEXACO Lubricants and Fuels

FOR THE AVIATION INDUSTRY

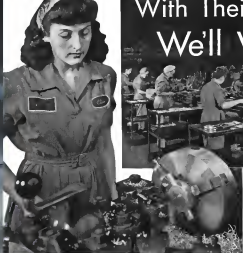
TUNE UP FORD ALLEN EVERY SUNDAY NIGHT—GET A HELP WITH THE WAR BY REFINISHING EMPTY DRUMS REGULARLY

AND *Back the Same Day!*
 Yes, even in rain, snow and ice,
 The MARQUETTE ALL-WEATHER
 WINDSHIELD WIPER
 keeps 'em flying!
 THE MARQUETTE METAL PRODUCTS CO.
 124 GACKWOOD DRIVE
 CLEVELAND, OHIO



Marquette

ALL-WEATHER
 WINDSHIELD WIPER



Three women, machining precision parts on South Bend Lathes in a war war plant, are typical of thousands of women who are doing their part to win the battle of production.

With eager hands and nimble fingers, thousands of American women are working shoulder to shoulder with men in vital war industries—replacing those who have left their machines to defend their country. And they are doing a fine job of filling men's shoes, for they know that the battle of production must be won to keep their men at the front supplied with the guns, planes, tanks, bullets, and thousands of other things an army must have to be victorious.

Women learn to operate South Bend Lathes in a surprisingly short time. Not that just any girl can become an expert machinist or toolmaker overnight. But in certain classes of work—the kind of work you would expect a beginner to do—women are highly successful.

With Their Help
 We'll Win



Quick to appreciate quality, women like South Bend Lathes. They like the fully rounded design with an exposed pulley, belt, or gears—the smooth operation of conveniently placed controls—the absence of rough edges and sharp corners that might catch their clothing—the dependable precision that makes them so true to workman production, even when extremely close tolerances are specified. And, most of all, they appreciate the ease of operation which reduces fatigue to a minimum and seemingly shortens the work-day by hours.

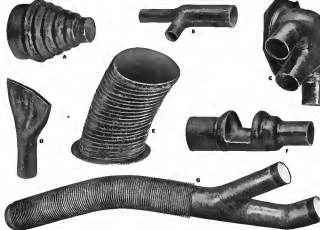
South Bend Engine Lathes and Toolroom Lathes are made in four sizes, 9" to 16" swings. South Bend Turret Lathes are available in three sizes. Write for information, specifying size and type of lathe in which you are interested.



"HOW TO RUN A LATHE" is a valuable booklet for the operator. Contains the operation and care of engine lathe, 16 pages, 100 illustrations. Free booklet for the operator.

SOUTH BEND LATHE WORKS
 SOUTH BEND, INDIANA LATHES BUILT FOR 36 YEARS





REPLACE CRITICAL MATERIALS

New U. S. Asbestos* Fabric Fittings Solve Problem of Heating and Defrosting Lines

Shown above are a few of the many intricate fittings made of Asbestos Fabric that are successfully doing the job of critical metals in aircraft production.

These fittings are designed in almost any conceivable shape or form required. They are made to withstand continuous heat of 400 F. and not deteriorate at temperatures as low as minus 40 F. They will not support corrosion.

In weight these units compare favorably with aluminum.

In addition to reducing substantial quantities of critical metals, Asbestos Fabric Fittings have marked advantages both in sound dissending and resistance to fatigue.

They are designed with an eye to the utmost adaptability and can be applied to any type of duct by three methods... cementing, clamping or arranging for quick and easy connection and removal by the use of U. S. Foster Quick-Grasp couplings... also made without the use of critical materials.

Complete information on U. S. Asbestos Fabric Fittings will be supplied promptly on request.

4000 U. S. Pat. Off.

Typical Applications

ILLUSTRATED

- A. Gun blast heat
- B. Magneto and oil cooler air duct assembly
- C. Exhaust silencer discharge
- D. Exhaust heat exchanger
- E. Conductor air intake
- F. Heat exchanger
- G. Turbo rotating fitting attached to U. S. Radio-Flex® Air Duct

NOT SHOWN ABOVE

Exhaust valves, defroster attachments and air connections to superchargers.

Now applicants of this important Asbestos development by United States Rubber Company are being revealed almost daily.

UNITED STATES RUBBER COMPANY



1000 Park Avenue • Rockefeller Center • New York



Good Automatics DESERVE Good Operators

Good operators can get the most from any machine, and, because seconds count so much, automatics should be kept in use at peak efficiency.

The Departmental Design of Conomatics helps new operators to learn faster. The extra rigid cross-slide construction permits holding heavier forming cuts to closer tolerances.

Cone handbooks are useful in helping both new and experienced operators to get excellent results from Cone machines.

PRIME YOUR PRODUCTION PULSE — SPLITCO CONES

CONE AUTOMATIC MACHINE COMPANY, INC.
WINDSOR, VERMONT
U. S. A.



AVIATION: February, 1945

CHAMPION SPARK PLUGS

are the dependable source of full, flowing engine performance, so vital to a Navy pilot at that crucial moment when an enemy ship—the never-to-be-forgotten prize, looms large in his sights. Champions are on active duty on every front.



Reports are continuously flowing in on our often cited service records of the outstanding performance, long life and extreme dependability of Champion Aircraft Spark Plugs, in engines of every type and size.

These case histories are gratifying to us and due results directly traceable to inherent qualities in materials and design which are

Characteristic Advantages of Champion Ceramic Insulation Are—

1. Immunity from heat and chemical reactions.
2. Freedom from fuel, oil, or moisture absorption which causes "shorts".
3. Incomparably high heat conductivity with consequent wider range between pre-ignition and fouling.
4. Absolute uniformity of material.
5. Flameproofness: no porous elements or spaces which cause leakage.
6. Fully cleaned and serviced—no special equipment or factory repairs necessary.
7. Scientifically controlled manufacture.

LET'S PUT THAT

30%

IDLE ALUMINUM TO WORK



TURN THESE...

REYNOLDS AIRCRAFT PARTS DIVISION

Specializing in SHEARING, BLANKING and ROUTING
Solves the Industry's Problems in

Every ounce of discarded metal is a lost finished part, not to scrap. The aircraft builder can use all the metal he receives, and without delay.

Thousands of pounds of aircraft skin are now lost or discarded as the type of equipment in Reynolds Aircraft Parts Division.

Tapping and drilling are among the principal Reynolds part-making operations. Capacity for this work is already large, and is constantly expanding.

Thirteen hundred ton haulage fleet, shown during installation, Reynolds uses over two million pounds of blocking capacity to the aircraft industry today.

Every piece is thoroughly inspected for dimensional and physical properties, size, gauge, hardness and surface.

Scrap from shearing, routing and blanking is removed at Reynolds plants immediately, without cost, by use of time, to shipment being a direct, or diversion of valuable metal.

SCRAP UTILIZATION

... Fully 30% of all aluminum sheet is lost in making aircraft parts. Reynolds puts this scrap metal back into use at once, at the aluminum source—eliminating months of storage, tedious segregation and handling, costly shipping, labor, and plant space. The Nation needs these extra millions of pounds of aluminum now!

MANPOWER

... Under the Reynolds' Plan, every piece of aluminum the plane builder receives is in finished parts, ready for assembly. Aircraft plants need not tie up their own precious skilled labor making dies and fabricating individual parts. Reynolds is prepared now to handle this work, leaving the plane builders free to build planes!

TOOLMAKING

... Parts to supply several aircraft plants building similar planes can be produced by Reynolds Aircraft Parts Division from a single set of tools. Wasteful duplication of both labor and materials in the critical tool-making field is eliminated.

TRANSPORTATION

... Fabricating parts and handling scrap at the aluminum source releases for after war production duties the thousands of freight cars formerly required to haul scrap metal back from aircraft plants. Using Reynolds' parts-making facilities helps break the transportation bottleneck!

MALLORY PARTS are Precision Parts



MALLORY Resistance Welding Electrodes and Holders: Mallory Standardized Spot Welding Tips and Holders, Mallory Seam Welding Wheels and Mallory Dies for flash or butt welding are opening fabrication of aluminum, aluminum alloys, stainless steel and other metals in practically all leading aircraft plants. Mallory supplies specially developed electrodes that produce neat welds between drawings... most replacement less often... and assure sound, clean welds at high production speeds... at lower cost. Write for the Mallory Resistance Welding Data Book.

MALLORY Electrical Contacts and Contact Assemblies:

Made of many efficient Mallory-developed alloys and pressed powder materials, these contacts and contact assemblies are used to activate a modern airplane's electrically controlled apparatus... from retractable landing gear to variable-pitch propeller. Mallory Contact Assemblies can save you production time when you need quantities of any given type of aircraft relay part! The Mallory Contact Data Book is an invaluable aid—we will send it on your request.



MALLORY Bearings are made by Mallory's Mallet Process of bonding silver to base metal bearings. They provide a tough, homogeneous, heat-dissipating silver surface of high fatigue resistance; ample strength and hardness; and high resistance to wear. Mallory has set remarkable records for maximum and uniformity in producing bearings, bushings, plain races, gear races and other aircraft engine parts.



MALLORY Noise Filters: Used in aircraft to suppress the static caused by spark-plugs, electric motors, inverters and other electrical equipment... and thus to insure clear communications.



MALLORY Approved Precision Products: This term also applies to the many kinds of electronic equipment and parts made by Mallory for the aircraft industry's use. For instance, Rectifiers... portable or stationary power units... are used for testing aircraft electrical apparatus, for charging batteries in airplanes and in airplane plants, for starting "gross" engines, etc. Also, condensers, vacuum controls, switches, vibrators, Filterpacks (vibrant power supplies), jacks, plugs and other electronic parts... made to high precision standards by Mallory... are used in aircraft and airport communications systems, in aircraft laboratories and plant control equipment.

U.S. Pat. 458

Our engineers are at your service.

P. S. MALLORY & CO., Inc.
INDIANAPOLIS • INDIANA

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MALLORY

Mallory services to the aviation industry have expanded their scope enormously. More and more aviation engineers are turning to Mallory while designs are still in the blueprint stage. They have learned that Mallory quality and Mallory experience insure dependable performance.



**ONLY SKILL AND EXPERIENCE
PRODUCE THE MASTERPIECE**

THIS applies equally well to sculpture and to castings.

To produce Wellman Castings a thoroughly trained personnel works with the most modern facilities. The result—smooth, clean, precise castings with that fine degree of accuracy which saves time, costs and speeds assembly.

★ Castings in brass, bronze, heat treated aluminum and magnesium (Dowmetal). Patterns of all kinds, sizes and designs.

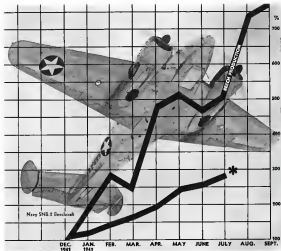
THE WELLMAN BRONZE & ALUMINUM COMPANY
General Offices: 2533 East 93rd Street • Cleveland, Ohio

WELLMAN means WELL-CAST



WELLMAN

CASTINGS X-RAY INSPECTED



Handbook & PB Maximum Production Index

Performance

Like the aircraft it makes for our country, the Beech organization has demonstrated a high performance factor. The graph above indicates the rate-of-climb of Beech production in the first year of our total war.

Beech Aircraft

CORPORATION

BENCHCRAFTS ARE DOING THEIR PART



WICHITA, KANSAS, U. S. A.

Minutes are NOT "Expendable!"



You can never recover or replace lost time. Every minute or hour saved is added to your production—increased output. And there are several ways **HECKER** tools can save time and so add to your productive hours.

HECKER tools are designed and built to reduce setting up time, to facilitate precision work, to help inexperienced workers reach and maintain normal output and to cut the number of rejects.

Much of the extra know-how that our engineers put into every **HECKER** tool comes from constant contact with our own production work on precision parts for aircraft. This first-hand knowledge of men, machines and varied job requirements is the plus in **HECKER** tooling service.

Let us work out your toughest tooling problem as a demonstration of **HECKER** service. Write A. W. Hecker, 197B East 66th Street, Cleveland, Ohio, or 517 New Center Building, Detroit, Michigan.



A-W Hecker

DESIGNERS AND BUILDERS OF TOOLS, JIGS AND FIXTURES—MANUFACTURERS OF AIRCRAFT PARTS



Federal
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BEARINGS



To further the war effort, we are today producing an ever-increasing supply of fine control bearings—**QUALITY BEARINGS**—for the air forces of the United States ARMY, NAVY and MARINES.



THE FEDERAL BEARING CO., INC.

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DROP FORGINGS

ON EVERY BATTLEFRONT



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PLANT AND GENERAL OFFICES

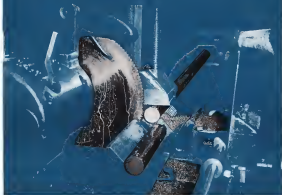
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TO MARK PROGRESS



ATKINS *Curled-Chip* SAWS



Best for War Work Because They TAKE LESS TIME FOR "TIME-OUT"

● The production loss caused by tool change-overs is one of those "necessary evils" that plague war plant production managers. It is no wonder, then, that Atkins Curled-Chip Saws have earned a good record for chips and features here pressed for more and more output.

The capacity of these saws for sustained cutting without re-sharpening is tremendous. On armor plate, copper, brass, aluminum, iron, steel or any other metal, curled-chip teeth are on record as cutting double, triple and even

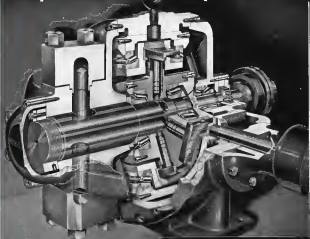
more material between saw change-overs. In addition they take a deeper bite of metal than was practical hitherto, cutting with greater accuracy on shell stock, shell blanks, gun mounts and many other important parts.

For full data on these productive-bearing saws, write for information on Atkins Engineered Cutting Service.

E. C. ATKINS AND COMPANY
144 E. Illinois St., Indianapolis, Indiana

ORIGINATORS OF THE *Curled-Chip* SYSTEM OF METAL CUTTING

A Dependable Source of Hydraulic Power



NO OTHER HYDRAULIC PRESSURE GENERATOR HAS THESE OUTSTANDING FEATURES:

1.—Tapered roller bearings maintain a positive mechanical separation between cylinder roller and control valve spindle.

2.—Take-up adjustment of tapered bearings is provided to maintain initial pre-loading for life. This is accomplished from outside of pump, without disassembling.

THE HYDRAULIC PRESS MFG. CO.
Mount Pleasant, Ohio, U.S.A.

Sole Sales Offices: New York, New York, Detroit and Chicago. Representatives in Principal Cities.

HYDRO ^{HPM} POWER
RADIAL PUMPS
AND CONTROLS
are the Basis for the
Dependable, Efficient
Operation of
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METAL WORKING
PRESSES



On Tomorrow's Cars...

AMERICAN PHILLIPS SCREWS

will give the same speedy, tight fastenings that meet battle-tests on today's planes

Phillips Drive-point fits snugly in tapered recess—WONT SLIP OUT—permits high-speed driving.



Unskilled men and women are now assembling planes, tanks, ships and guns faster and stronger with American Phillips Screws than was ever possible using slotted-head screws and highly skilled labor.

American Phillips Screw Driving is quick and effortless:
1. Place the point of the Phillips Screw Driver in the Phillips Recess for centers automatically.

2. Aim the driver with one hand. Other hand holds the work.
3. Press the power-drawer trigger... another American Phillips Screw drives straight and tight, with its head indented and the work surface unmarred. The Phillips drive cuts a slip out of the Phillips Recess Head... can't cut any way but straight in the tapered recess. So women and unskilled men hit top outputs at once, without under fatigue or tool-cutting accidents. Production records and battle records prove American Phillips Screws to be among the powerful weapons of this war...

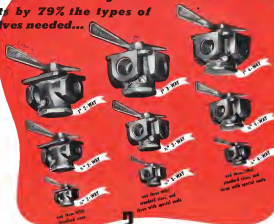
...for they make our fight an easy task. And in the world of tomorrow, American Phillips Screws will, then as now, deliver highest speed at lowest cost. But right now, if you have assembly trouble on your work, you can save operations, time and materials with American Phillips Screws.

AMERICAN SCREW COMPANY

Providence, Rhode Island

CHICAGO DETROIT
3519 E. Illinois Street 4-253 General Motors Bldg.

The HARVILL Plug Valve Standardization Plan cuts by 79% the types of valves needed...



Standard Fittings make these 3 types of Harvill Plug Valves adaptable to THOUSANDS of services

Behind the Harvill plug valve standardization plan is a long and detailed study of plug valve inventory and substitution problems—and ways that would reduce to a small size the enormous number required up to this time.

Harvill is an entirely new and greatly simplified plug valve "set up"—pioneered by Harvill for the benefit of the entire aviation industry. NOW, with three basic types of Harvill plug valves and standard fittings which are available and generally stocked by manufacturers, the industry can eliminate thousands of wasted man-hours and frozen capital tied up in a multiplicity of plug valves... because exactly 34 Harvill plug valves TAKE THE PLACE OF 1100 valves of "non-standardized" design.

Write for detailed literature and specification sheets—find out how the Harvill standardization plan can wipe out 77% of your plug valve problem... without changes in piping layouts or installation procedures.

HARVILL CORPORATION

A FORMERLY HARVILL AIRCRAFT AND CASTING CORP. - ESTABLISHED 1928 -

6251 W. Century Boulevard, Los Angeles, California

OTHER HARVILL PRODUCTS OR SERVICES

PRECISION MOLD CASTING
This feature lets you have the most exacting tolerances and the most perfect finish in the industry.

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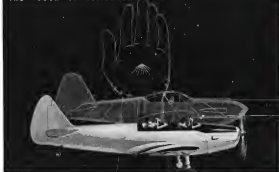
PRECISION WELD CASTING
This feature lets you have the most exacting tolerances and the most perfect finish in the industry.

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THE TOUCH OF TOMORROW IN THE PLANES OF TODAY



Fairchild PT-19

A Reliable Primary Trainer With Fighter Characteristics

When Fairchild created the PT-19 primary military trainer back in 1935, it combined aerobatic tactical design with great ruggedness and reliability in satisfaction of the exacting function the plane was to perform. When war came, the PT-19 was ready—a reliable primary trainer with "fighter" characteristics. Today, this trainer is being produced for the United Nations by Fairchild and the same plane with slight modifications is being built by three other firms in the United States and two in foreign countries under Fairchild license agreements. The same Fairchild "know-how" that created the PT-19 recently completed the AT-16 advanced

crew trainer, an all-Duramold two-engine tactical training ship only one step removed from the bomber itself. Both planes are powered by Ranger in-line air-cooled engines.

These two types of trainers not only speed student transition to warplanes but set the engineering pace required to provide the tools of Victory. They reflect the "Touch of Tomorrow" that has marked every

Fairchild engineering achievement for two decades—the "Touch of Tomorrow" that is today shaping things to come . . . next month, next year . . . from Fairchild drafting boards, laboratories and production lines.

ON THE BEAM

"This government, the offspring of your own choice . . . has a just claim on your confidence and your support." George Washington

Fairchild Aircraft Division of Fairchild Engine and Airframe Corporation, Hagerstown, Md.

AVIATION, February, 1945

THESE TOOLS OF PEACE ARE MAKING THE WEAPONS OF WAR

Here are some of the VARD precision-made inspection and production tools which in hundreds of war factories are turning out accurate, difficult work, quickly and efficiently. ALL VARD products conform to prevailing technical standards, and represent the best in design, materials, and workmanship.

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"...This award is just another tribute to your greatness and to your great work in backing up our soldiers on the fighting lines"

W. P. ...
Under Secretary of War

EMERSON-ELECTRIC War Products



**POWER-OPERATED
AIRCRAFT GUN TARGETS**

These heavy caliber fire power, mounted targets protect our Army, Navy Bombers and Torpedo planes against enemy fighter attack.



**PART 195
ARTIFICIAL ANNOYANCE**

Traditionally dull, boring and tedious for U. S. soldiers are now leading to the efficient power of our armed forces.



**ELECTRO-MOTIVE CONTROL
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The fighting power and safe control maneuvering of modern war planes depend upon precision high voltage motor controls.

AFTER VICTORY... Back To The Job Of Serving The Nation



ELECTRIC FANS

The most complete selection of quality fans in America with the famous 3 Year Guarantee, is represented in 1944.



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For household, farm, commercial and industrial applications and large power machines... Also, for aircraft controls.



REINFORCED COMPOUND

Higher handling and air-coupling for homes, farms and commercial use in the industry and commerce.



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The most modern of metal fastening methods is made available in a variety of sizes through these company, complete units.

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A VALUABLE NEW BOOK FOR YOUR DATA FILE

Among other important matters, this booklet contains the following: • First publication of the results of tests that show how to get maximum length of service from cable operating over pulleys. • Formula for estimating Elastic Stretch of Aircraft Cable. • Data on Fatigue and Tensile Strength tests. • List of cable construction commonly used—and their recommended applications. • Table of Tensile Strength and shipping weights—all constructions and diameters of Carbon Steel and Stainless Steel Cables. To make sure that you get a copy of this well-illustrated booklet, write at once on your company's letterhead.

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ESSENTIAL PRODUCTS... TRU LIFT Anchor, Automobile, and Industrial Controls, TRU LOC Aircraft Tensioning, AMERICAN CABLE Wire Ropes, TRU STOP Brakes, AMERICAN Chains, WYED The Chain ACCORD Malleable Castings, CHAINFLEX Cutting Machines, RCD Road Testers, HAZARD Wire Brakes, Ford Flapping, HARMONY Auto Service Equipment, QWIK Springs, PACE Pumps, Shear Weld, Welding Wire, BLADING TRAIL & CABLE Travers, BLADING Barbed Steel Cables, WYBRIGHT Brakes, Chain, Friction... In Demand for Your Safety



Storage tanks happen to men and machines in the world above our world... the bitter cold, almost insupportable and awful world of the stratosphere.

There every man's life is carried in his own oxygen cylinder.

The valves and cylinder that provide oxygen for a stratosphere pilot are as important to him as his own arteries and heart... and they must be just as reliable.

Special lightweight cylinders and valves for high-altitude flying were developed by Walter Kidde & Company, specialists in compressible gases.

These same Kidde specialists also developed the carbon dioxide isolation equipment for the rubber suits that saved the lives of Capt. Eddi-

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On planes, tanks, PT boats, ships and in factories, Kidde fire-fighting equipment guards against flames.

Great advances are being made in the field of useful compressible gases. Pioneers in this field, Walter Kidde & Company has developed scores of startling applications for our varied valves and for industry. After the war, these developments will help make a safer, happier peace.

For information write Walter Kidde & Company, Inc., 223 West Street, Elizabeth, N. J.



SPEED is the keynote of America's War Effort
SPEED in armed striking power
SPEED is the production of the tools of war

In almost every industrial operation, metallurgical cleanliness is essential for fast production and finished performance of the finished product. In welding, plating,

painting, drop-hammer — scores of operations — the use of Kelite materials for cleaning and processing has resulted in faster production — better performance.

Treatise on the most efficient methods of Anodizing and Cathodic Plating, Resistance Welding, and many other improved industrial processes will be sent on request. Our laboratory-trained, production-line-experienced technicians are immediately available for consultation.



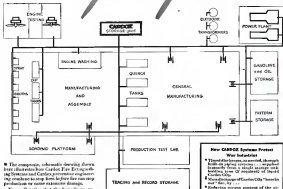
909 East 60th Street • Los Angeles, California

BRANCHES IN PRINCIPAL CITIES • MANUFACTURING PLANTS IN LOS ANGELES, NEW YORK, CHICAGO, HOUSTON

AVIATION, February, 1943

PREVENTIVE ENGINEERING

For Fires



■ The complete, schematic drawing shows how the entire CARDOX Fire Extinguishing System and Cardox preventive engineering can be used to stop fires before they can start production or cause extensive damage.

You will notice that the basic unit is central, both in number and diversity. In each case preventive engineering provides an entirely practical solution—integrating in advance and drawing right into the blue-print individual based requirements for every fire protection.

What else makes us so sure of this? With a Cardox System you can protect every hazard in your plant with an application specifically engineered to the fire situation involved, and all part of one complete system.

Further, you obtain the proved, positive advantage of Cardox System's advanced fire extinguishing performance. Cardox systems extinguish fires by mass discharge (in fact, if needed) of Cardox CO₂, supplied from a

single Storage Unit that stores from 750 pounds to 125 tons of liquid carbon dioxide at controlled low temperature.

Universally installed Cardox Systems in the engineering of Cardox Systems to meet the most varied needs. Whether you need qualitative systems, Cardox preventive developments a part of your fire protection planning. Write, or company literature, for Bulletin 121.

CARDOX CORPORATION
3211 BUILDING • CHICAGO, ILLINOIS

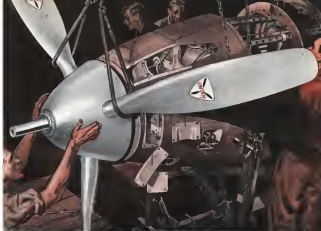
New York • Washington • Detroit • Montreal • Atlanta
St. Louis • St. Paul • San Francisco • San Antonio • Seattle

New CARDOX System Protects Your Industries

- **Threat of leakage, as needed, through built-in piping systems**... equipment is made from a single storage unit holding, in one of equivalent of liquid Cardox CO₂.
- **Non-discharge of Cardox CO₂ "leakage"**... by...
- **Isolating system**... of the atmosphere before the concentration increases for combustion, etc.
- **Cooling**... and low heat... before ignition temperature...
- **Extinguishing**... fire quickly and completely without damage from water-producing reactions.

CARDOX-CO₂ Systems with Advanced Fire Extinguishing Performance

- Effectiveness of CO₂ atmosphere**... extinguishes fires without effect on the product.
- Complete protection of CO₂ through gas-tight systems**...
- Threat of leakage, as needed, through built-in piping systems**... equipment is made from a single storage unit holding, in one of equivalent of liquid Cardox CO₂.



Another "slugger" off the line... complete with Aero-prop!

IT'S LIGHT—The Aero-prop has earned a hard-earned nickname—the slugger. The slugger shown above is getting its Aero-prop.

IT'S LIGHT—Propulsion in a single plane makes a terrifically light Aero-prop. It is built to withstand abuse and to "hold up" under stress of combat service.

IT'S LIGHT—The Aero-prop is built to withstand abuse, but it also saves time that's even more precious. Compact construction makes it possible

one of America's finest fighting ships has earned a hard-earned nickname—the slugger. The slugger shown above is getting its Aero-prop.

You'll notice one particularly interesting fact in this production line view of a fighter in the making. The Aero-prop is going on the ship as a single, compact unit. In a matter of minutes the complete package will be fully installed and ready for flight.

Thus, the Aero-prop saves installation time, but it also saves time that's even more precious. Compact construction makes it possible

to check and service an Aero-prop in double-quick time, and that is a big advantage at the fighting front. When the best is on, every maintenance minute saved is a fighting minute earned.

From one black tip to hollow hub the Aero-prop is engineered for top combat efficiency. It is rugged, strong, light. With each passing day the Aero-prop's performance becomes an increasingly decisive factor in America's air strength—because every day more and more planes are going off the production line and onto the fighting line—complete with Aero-prop.

AND DISCHARGE OF CO₂
BRINGS COOLING EFFECT
CENTRAL STORAGE UNIT
AIRS CO. SERVICE
ENGINEERING
MAKING AN AUTOMATIC CONNECTION

CARDOX

NON-DAMAGING FIRE EXTINGUISHING SYSTEMS



AERO-PRODUCTS
DIVISION

GENERAL MOTORS
CORPORATION





● Executives are invited to write for this informative 36-page brochure titled "Ingenuity." In it is illustrated and described our facilities and spirit... Please use your business letterhead. Joseph J. Cheney, President.

Spriesch ESTABLISHED 1929
TOOL & MANUFACTURING CO., Inc.
 17 HOWARD STREET • BUFFALO, NEW YORK

PERISCOPE

Now a tank can see over a hill!
 Dependable Lycoming-powered
 Scorpion "Sentinel" ships are acting as
 periscopes for our mechanized units
 operating in the four corners of the
 earth. Through blistering heat and
 tropical storms Lycoming power never
 falters in the vital role of powering
 the periscopes of Uncle Sam's "land
 deadweights."

**LYCOMING
 AIRCRAFT ENGINES**

The Engine Place Since 1912
... The Engine Place Since of Tomorrow

Lycoming Division, The Aviation Corporation
 Williamsport, Penn., U. S. A.

THIS
RING

LOCKS

STUDS AND INSERTS
IN ALL MATERIALS

If the Material Can Be
Threaded, The Rosan
Locking Ring Will Hold
on Insert or a Stud
Permanently in Place.



THE ROSAN LOCKING SYSTEM

The Rosan locking System, which is based upon various applications of The Rosan Locking Ring to threaded inserts and studs, has solved a problem which has baffled engineers since the invention of the screw.

This problem of locking a threaded insert in a harder or softer material, had hitherto been considered impossible of solution. Ordinary threaded inserts will turn and loosen under vibration, and in the case of the stud, the torque necessary to disengage a frozen nut, will invariably necessitate the use of an oversize replacement.

The Rosan Locking System has eliminated these conditions. Under this system, any amount of force may be applied to a frozen nut without disturbing the stud. The Rosan locking Ring holds it in place permanently.

HOW IT WORKS

The principle of the Rosan Locking System is very simple: a locking ring serrated both inside and out, engages its inner teeth with a serrated collar on the insert or stud. The outer teeth mesh tightly into the softer material when pressed at down into place with a firm tool, making the insert or stud an integral part of the softer material... and completely permanent.

THREADS UNDISTURBED

When driving the Rosan Locking Ring into another material, the force is applied only to and directly to the ring, without forcing or disturbing the threads of the insert.

BARDWELL & McALISTER, INC. • 7628 Santa Monica Blvd., Hollywood, Cal.
DESIGNERS & MANUFACTURERS



BROACHES WITHOUT DISTORTION

The broaching action of The Rosan Locking Ring is accomplished without the slightest distortion or fracturing of the softer material.

AN INVITATION

The Rosan Locking System has an infinite number of applications in all types of industry. Manufacturers and engineers are invited to submit their problems to us.

Patented Pending



Note that the ring has been permanently locked between studs and inserts having same size of serrated collar.



Note reaction to surface and not interchangeability with any other.



(1) Rosan Locking Ring is driven into material, forcing insert into place.



(2) Insert is placed into hole with surface of material. Note the action of the locking ring.



(3) Insert locked in place. Note reaction of material with both of collar. Note permanent locking of material.

NEWS BULLETIN FROM MAGNAFLUX CORPORATION—

Sub-Contractor Inspections Prevent Battlefront Breakdowns



Reversed joint cracked during stress test.

Magnaflux Service

As inspectors and producers of the Magnaflux Methods, Magnaflux Corporation and its engineering staff have accumulated an unsurpassed fund of specialized knowledge and experience in this subject. This is placed at the disposal of industry in the service which is extended to Magnaflux users. Included certifying for operators, all necessary tests, repair materials by field engineers, laboratory services, etc.



As the new standard sub-contracting, parts inspection became more important. But even more than a matter of life and death when parts were likely to fail under battle conditions.

The Magnaflux Corporation, as pioneer in non-destructive testing methods for every metal part on the production line, welcomed two developments among manufacturers:

- (1) Prime Contractors not already benefiting from Magnaflux Service turned to the Magnaflux Corporation for best practical inspection methods as a check on sub-contracted parts;
- (2) Sub-contractors for companies

without Magnaflux Service did the same with their own parts to prevent later claims by the Prime Contractor.

In many cases the question was taken out of their hands by Government specification of Magnaflux Methods.

This all points to one conclusion: the display will serve as a magnetism of all parts prior to shipment or assembly on standard practice. Let the Magnaflux Corporation make quick positive inspection a routine step in your production. Time and money saved easily offset the expense. The right method can be recommended for you by a Magnaflux engineer. Write us for Bulletin B 455.

MAGNAFLUX CORPORATION

5736 Northwest Highway, Chicago, Illinois



POWER TO WIN

HORSEPOWER! — not of faithful horses giving their utmost as in years gone by, but the tremendous horsepower of America's mighty engines — is giving America and her Allies the Power to Win . . . Today, Continental Red Seal Engines — giants of dependable power — are "in there," battling on all fronts. These engines, famous for more than 40 years, are constantly making new records for dependable stevedores — on land, on the seas, and in the air.

Your Dollars
are Power, too —
Buy War Bonds

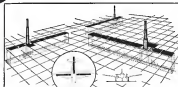


Continental Motors Corporation
Aircraft Engine Division
MUSKEGON, MICHIGAN



Globe Portable Electric Hydraulic Hoist, Type A-78
Max. Weight 2000 lbs. and rated 17 1/2 in. lifting capacity
\$1,000.00. Safety for persons, aircraft, property.

Now GLOBE PIONEERS WITH POWERED HYDRAULIC HOISTS FOR PLANES...

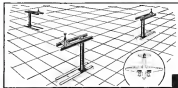


Capable of lifting big bombers, cargo carriers or light fighter planes . . . quickly . . . smoothly . . . without manual effort . . . Globe Airplane Hoists provide greater speed, convenience and safety in assembling and servicing. Landing gear can be retracted and fuselage lowered to floor level for greater accessibility . . . doing away with unbrandy and dangerous high platforms.

Like so many important parts of modern planes, Globe Airplane Hoists utilize smooth, extremely-controlled all-hydraulic power. They are designed and built to the same standards of safety and performance that have established the outstanding reputation of Globe Auto and Bus & Truck Hoists.

Only a few of many types of Globe Hoists — designed to meet the needs of the aircraft industry — are illustrated here. Some of these are now being used very successfully by several of our largest plane builders . . . need or apparent — we know how and where. For a folder showing additional types, or for engineering consultation on your particular hoisting problems — write to us at Philadelphia office: Harwood Lane at Queen St.

GLOBE HOIST COMPANY
PHILADELPHIA, PA. 801 NORTH, IOWA



Q71 GLOBE TRACK TYPE BUSHING
Q72 TYPE A-30 BUSHING
Q73 TYPE A-30 BUSHING
Q74 TYPE A-30 BUSHING
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Q78 TYPE A-30 BUSHING
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GLOBE
HYDRAULIC AIRPLANE HOIST

They're worth more than money to me



"Well, I don't usually put my Blackhawk Wrenches in the safe at night, but I do keep 'em under lock and key. Today, these Blackhawks of mine are worth many times their original cost in the work they run out and the profits they earn."

Man, you said it! MODERN Blackhawk Wrenches are rugged, speedy and dependable. Talk about guts — say, they're built to run the toughest jobs men enter. Packed with exclusive features that make 'em the smoothest working tools you ever got your hands on. That's why Blackhawk Wrenches are doing such a great job in all branches of automotive and science industries, from production to service and repair.

See, wrenches are scarce these days — but your jobber may still have some Blackhawks in stock. Or, if you are in "high priority" war work — your ring can help your Blackhawk jobber assure reasonable delivery.

See your Blackhawk Jobber Salesman — or write us for free 16-page "HANDY GUIDE," giving helpful wrench data.

A Product of BLACKHAWK MFG. CO.
Dept. W91151 Milwaukee, Wisconsin



BLACKHAWK

ATTENTION, February, 1948

**SHAKEPROOF
COWL FASTENERS**

ONLY 3 PARTS



Spring Unit



Bolt



Bush Pin

**Easy
TO INSTALL!**



1

Units are drilled to allow air to be forced. Countersunk holes are used for Bush type assembly.



2

Spring unit is inserted in lower plate with stress of Shakeproof Thread Locking System.



3

Bolt is put through hole in lower plate and over pin is inserted with special plate into only special tool required.



4

Units are easily locked superior to existing steel through existing unit and moving about a quarter inch with desired fit.

● Shakeproof Cowl Fasteners have been engineered to meet every requirement for the fast assembly and dependable performance. The design of the fastener incorporates a reinforcing base as an integral part of the spring locking unit. This eliminates stresses and actually reinforces the adjacent primary structure.

Shakeproof Cowl Fasteners are easy to install on the assembly line and easy to operate in the field. Samples are available for aviation engineers and production executives — a request on your company letterhead will bring you a test kit by return mail.

AVIATION



DIVISION

SHAKEPROOF inc.
Fastening Headquarters

2000 South Street, Chicago, Illinois

1000 South Street, Chicago, Illinois

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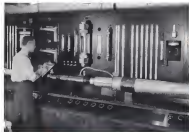
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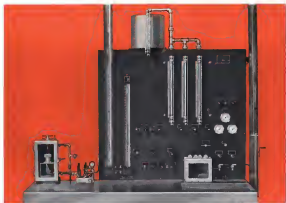
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"BENDIX-STEEL-DENTAL" Shock Struts and "BENDIX" Wheels and Brakes are important members of "The Invisible Crew" of production equipment which fit Landing Gear from aircraft to street are spending 12 months before birth.



Mining—Number One War Industry

The mineral products of the earth are the prime necessities of war...and peace

THE SURFACE of the earth provided primitive man with the things he needed for his meager existence but civilization really began when he became curious about its interior. This curiosity has brought us a long way. For the earth has yielded—out of its deep recesses—all the raw materials of modern industry. And today, in the grueling race of production, our mining industry is providing the raw materials upon which depends our survival. Our mines and quarries must supply a long list of materials without which a successful war cannot be fought.

Take steel, for example. War without steel is inconceivable. Steel starts with iron ore, limestone and coke. These are products of mines and quarries. It takes power and heat to get these materials out of the ground, to refine them and to transport them to the point where processing begins. All the subsequent operations culminating in the steel ingot, shape or plate, and in moving the final product to the point of use require power and heat.

The major source of this power and heat is coal.

Production of a ton of steel, it has been stated, requires two tons of coal. Smelting of the pig iron alone, 60,000,000 tons in 1942, required the coking of some 75,000,000 tons of coal. Pig output is expected to rise to 68,000,000-70,000,000 tons in 1943, ensuring coal consumption up to 85,000,000 tons. At the same time, output of steel ingots is expected to rise from 87,000,000 to 97,000,000 tons. Think what this means in terms of power and heat.

Another vital metal is copper. Modern armies need copper. This point is dramatically illustrated in a recent memorandum by Robert P. Patterson, Under Secretary of War, in announcing the release of 4,000 men from military service to return to the mines and increase copper production. "In a single minute of combat," Mr. Patterson declared, "a flight of 50 fighter planes shoots away 7 tons of copper. A 37-mm. anti-aircraft gun uses up a ton of copper every twenty minutes it is in operation. Six hundred pounds of copper go into every

medium tank, and a ton into the engines and armament of a Flying Fortress. The Signal Corps alone needs 5,000 tons of copper every month for radio and telegraphic and telephone equipment. An army without copper would be an army without speed, maneuverability or firepower. It would not last a day in battle."

Seven tons of copper for one minute of combat by 50 fighter planes means from 200 to 700 tons of ore, depending upon ore grade. Small wonder that the War Department was willing to release drafted miners from military duties to produce more copper.

But other metals are equally important in war. tungsten, nickel, manganese, chromium, vanadium and molybdenum for alloy steel, zinc for brass and die castings, tin for bronze and bearings, aluminum and magnesium for aircraft, lead and mercury for ammunition; silver for electrical equipment, bearings and solder, and so on. Even relatively insignificant non-metals, like ruber and diamonds, suddenly assume critical importance.

And let us not lose sight of the fact that without adequate energy, i.e., heat and power, production, processing, transportation and the relative comforts to which we have become accustomed would be impossible under war conditions. Coal is the major source of energy in the United States. It supplies more than half the total in normal years.

The railroads of the country alone used 110,000,000 tons in 1942 to move freight and passengers and service their facilities. Utilities consumed over 68,000,000 tons in the production of electric power. Over 185,000,000 tons of coal were consumed last year in maintaining the level of living comfort necessary for the maintenance of efficiency and morale. The consumption, this year, will be even greater.

In short, the mineral products of the earth are the prime necessities of war.

The nations that control the world's mineral resources and make the most efficient use of them will win the victory.

Before the war, the British Empire and the United States together controlled probably 75 per cent of the world's mineral production. This would have been a most potent weapon in the United Nations' arsenal if the whole strategy of Axis expansion had not been influenced by mutual objectives. Addressing the American Zinc Institute on the subject last April, E. W. Johnson, of the U. S. Bureau of Mines, estimated that the Axis had improved its position in world mineral resources in the following percentages: iron ore, from 6 to 46; steel production capacity, 20 to 34; petroleum, 1 to 7; coal, 27 to 53; copper, 5 to 10; lead, 7 to 25; zinc, 16 to 28; tin, 1 to 73; manganese, 2 to 36; chrome, 3 to 50; tungsten, 6 to 60. In the light of these facts, it is not surprising that the Axis has been able to produce in 1940 54 per cent of the world's aluminum, 49 per cent of the bauxite (the principal source of aluminum) and two-thirds of the magnesia.

Despite these gains, the industrial war power of the United Nations still can outweigh that of the Axis by a considerable margin. It already has begun to surpass it. The problem is to convert quickly our potential mineral resources into ingredients of war. In this connection, a heavy burden of responsibility has been placed on the mining industry of the United States as the largest producer of many metals, minerals and fuels. In fact, the United States mining industry began to go on a war basis a year before Pearl Harbor. The curves of demand for domestic copper, lead, zinc and other metals began to rise sharply in 1940, and were paralleled by a corresponding increase in production.

How well the job has been done cannot be revealed in accurate figures in many cases because of censorship. In metals, however, some idea of production gains can be indicated in comparative terms. United States copper production, for example, is breaking all previous records. Aluminum capacity will be more than seven times its annual peacetime average. Magnesia plants now building will have a capacity 100 times the largest yearly

before the war figure. Molybdenum, of which the United States has the largest single mine in the world, is being made available in record quantity. Zinc, lead and mercury are surpassing expectations as meeting wartime demands, and tungsten, chromium, manganese, antimony and iron and steel are being turned out in record-breaking quantities.

Rhuminous coal production in 1942 was 580,000,000 tons, the greatest in history, valued at more than \$4,300,000,000 at the mine. Some 430,000 or more men were employed in 1942 and received at least \$750,000,000 in wages. Rhuminous production in 1939 was 594,835,000 tons, while the output for 1941 is forecast at approximately 600,000,000 tons — another new United States record. The 1942 anthracite output was 59,561,000 tons, valued at over \$270,000,000 at the mine. The industry employed some 85,000 men and paid out at least \$180,000,000 in wages. The 1939 production of anthracite was 51,487,000 tons, and the forecast for 1943 is 65,000,000 tons or more.

Marshalling the Western Hemisphere's mineral resources, the United Nations have been the beneficiaries of the diversified resources of two continents — in particular of Canada's nickel and coal, Mexico's lead and antimony, Chile's copper, Bolivia's tin, Peru's vanadium, Brazil's iron, and Venezuela's petroleum. With other United Nations contributing their share of metals and fuel, the grand total is an impressive array of potential materials and methods to lend assistance of certain victory over the Axis. Shortage of metal, properly said, will win the war, and our mineral industry will have played an indispensable and essential part in the inevitable outcome.

James H. McEwen, Jr.

President, McGraw-Hill Publishing Company, Inc.

Wheels for Production

IN 1944 the aviation manufacturing industry is called upon to double 1942 plane production in terms and increase total passenger fleetfold. Although this will not be easy, it should be well within the realm of possibility for an industry which has been doubling and redoubling its output steadily for the last three years—in spite of hardships on every side. Some of these hardships have been the result of unforeseen war contingencies which should have been foreseen. Some may be traced back to old weaknesses in strategy and planning. And many of the subsequent attempts to find solutions have been negative rather than positive in their approach.

Probably the greatest single threat to the aviation production program for 1943 is the critical shortage of transportation and of housing with which we are now faced as defense areas. These two problems must be considered together because of their joint effect on the manpower situation, which will be one of the major headaches of 1943. We have built most of the factory facilities for the present program.

Todays of this hour upon is progressing rapidly and in most cases has been completed. The next important step is to make greater use of these facilities by increasing personnel to the fullest extent. In order to accomplish the production objectives set for this year, we will have to recruit almost as many more workers as we had in the industry at the end of 1942.

THEY ARE NEW ARMY OF workers that must be raised this year must also include replacements for military separations and for workers lost to other industries because of slack periods while waiting for materials and supplies. In order to do this it will be necessary to draw heavily on all available sources of overage and handicapped workers, and a very substantial number of the new workers must, and will, be women.

There are many facilities where the available personnel will be insufficient to meet the demand, hence we have to prepare ourselves to face the problems of migration of labor. When migratory labor includes women,

the housing problem becomes much more acute because the available staff side requires more adequate living quarters. Already there are plants in which full production cannot be achieved because of housing shortages. When housing facilities are overtaxed, the problem becomes one of transportation between the plant and the nearest accessible community.

APPROXIMATELY 80 PERCENT of the aircraft workers are now using private automobiles for commutation to plants. Last year's drives to increase passenger car loadings have been so successful generally that there is not much passenger car capacity remaining to be tapped. Public transportation facilities have been dangerously overstressed by the recent boom in non-aerated driving in the East. These facilities elsewhere are seriously overloaded. And most aviation plants, particularly those dispersed in the wide-open spaces, are so isolated as to depend almost entirely on transportation by private automobile. Some means must be found to enable the new hundreds of thousands to reach their work.

Manufacturers who have not yet done so, should re-examine their housing and transportation requirements in the light of their expanded production assignments for 1943 and take whatever steps are within their power to increase housing and transportation capacity.

But the greatest responsibility lies with the several government agencies concerned with these problems. Unless emphasis is shifted from the negative policies of curtailment to the positive procedure of acceleration of all the programs necessary to the expansion of essential transportation and housing our industrial machine will, this year, bear the brunt of our losses of tankers, merchant shipping, and rubber in early losses in the Atlantic and Pacific.

Yoshio E. Naito



Lt. Gen. Henry H. Arnold



Lt. Gen. Delos C. Brinkley

The American Doctrine Of Air Power

Part I

By HATHANIEL F. SILSBEE
Wing, Air Corps

Our country has developed its own theories of war in the air. They have shed the dust of battle, have revolutionized even the most modern concepts of waging war. This series of two articles describes this doctrine, tells where and where it was conceived, and credits the men responsible for it.

WHEN Capt. Eddie Rickenbacker returned from an official inspection trip to England made at the request of Gen. Arnold he reported to the Secretary of War that "American conceptions of Army aircraft and their tactical employment are proving sound in combat and that the British look upon the present application of air war as theories with increasing approval."

What are these American "air war theories?" When and where were they conceived? Who are some of the men responsible for their development?

Although the aviation contribution of this country in World War I was

more considerable than is commonly supposed, it is safe to say that the real beginning of American air power, so far as the Army is concerned, may be dated from March 1, 1919. On that date the GHQ Air Force was established, embracing all tactical Air Corps units within the United States. The Army Chief of Staff, Gen. Douglas MacArthur, secured a temporary irregular promotion for Col. Frank M. Andrews, of the Air Corps, and directed that he select a staff, proceed to Langley Field, establish his headquarters for the General Headquarters Air Force, and see what he could do on a paid trial.

Gen. Andrews selected for his chief of staff Col. Hugh Kerr, retired of Fort Monmouth, and who from 1905 to 1910 was commander of the 2nd Bombardment Group, Langley Field. He was succeeded in 1915 by Brig. Gen. George H. Brett.

Gen. Andrews' air command consisted of four Bombardment groups, three pursuit (now called Fighter) groups, and two attack (now Light Bombardment) groups organized into three Wings. The First Wing had its headquarters at March Field, and its initial commander was Brig. Gen. (now Lieut. Gen.) H. H. Arnold. Some of its elements went back to the victorious climax of the World War I at St. Mihiel and Meuse-Argonne. Gen. Arnold, in new commanding general, Army Air Force, which passed the aviation mark in November and is now well on the way to more than double that figure—the most powerful and far the world has ever seen.

The First Wing was later com-

manded by Brig. Gen. Delos C. Brinkley, who in 1920 succeeded Gen. Andrews as commander of the GHQ Air Force and who became the commanding general of the Air Force Command, Command in 1925 (which succeeded the GHQ AF). The first air officer to situate the work of lieutenant general, as is now commander of the Army Department, air and ground forces, Division division.

The Second Wing had its headquarters at Langley Field where, under the very shadow of the GHQ headquarters, it built up an amazing history of achievement through practical experimentation—a strenuous proving

ground for war ideas, particularly as regards long range bombardment.

The Third Wing, stationed at Berkeley Field, compared attack and pursuit groups (no bombardment). Attack and Fighter aviation was developed at Berkeley, as Bombardment was at Langley.

Main purpose of the GHQ Air Force was to coordinate the various systems of air training so as to produce uniformity and the ability to operate together as a team. Another accomplishment was the later development of the combat crew as a fighting team which could fly, bomb, and shoot. In practice, the same officers and men



Lt. Gen. Frank M. Andrews



Col. Hugh J. Kerr



Maj. Gen. Delos C. Brinkley



Lt. Gen. George Henry

Lt. Gen. Joseph T. McNamara



Fig. 1. British as Air Force power, now being sent to France as a more step in excess development of long range bombers produced on American theory that such planes have become of air power.





Maj. Gen. Robert Olds



Brig. Gen. Clark V. Hays



Maj. Gen. Harold Lee George



Maj. Gen. Lewis T. Sherman



Maj. Gen. Ira C. Eaker



Brig. Gen. Wilfrid M. Hale



Brig. Gen. Eugene S. Roberts



Lt. Gen. George H. Brett



Fig. 2. Expansion ideas of Army Air Forces have found greatest measure of success in developing concepts of Consolidated B-24 Liberator (above) and B-29 Superfortress (right). With water pattern of American entry into world conflict fully and properly anticipated by G.H.Q. these heavy bombers were developed in schemes to meet all threats for role of ending war by air attack, and finally to crash enemy at his point of maximum advantage. Various stages of these concepts in previous air wars in Pacific, where attacking Japanese were finally stopped, and air war being rolled back, and in Asian European theaters where Germans are already staggering under crushing Allied aerial offensives paved the way for present and future.



were assigned to the same airplanes, and each team, through constant supervision, was able to attain a high degree of proficiency.

A Halfway Success

Under Gen. Anderson's leadership, in the brief period of four years, the GHO Supply Air Force achieved recognition as a vital element in our national defense strategy. Heavily mobile and powerful, it has repeatedly proved its ability, in vital crises on the Coast Range, Alaska, Pacific Islands and elsewhere, to be moved and moved, and still others are being quickly from one part of the hemisphere, operating from bases in England, in another, to modern headquarters of Africa, the Middle East, India, China, New Guinea, the Solomon Islands, Australia, and elsewhere, according to the needs of the war. A visit to the Air Force has been led at last.

The GHO Supply Air Force, as we have learned the Air Force Combat, by command in June, 1941. And in March, 1942, as a result of the program, the Air Force will have complete detail and command of the entire Army, which trained the personnel and pro-

vided the equipment in the Army Air Force, one of the three great divisions of the Army, to equal with the Army Ground Force and the Service of the Army.

The first four Air Forces cover the vital element in our national defense strategy. Heavily mobile and powerful, it has repeatedly proved its ability, in vital crises on the Coast Range, Alaska, Pacific Islands and elsewhere, to be moved and moved, and still others are being quickly from one part of the hemisphere, operating from bases in England, in another, to modern headquarters of Africa, the Middle East, India, China, New Guinea, the Solomon Islands, Australia, and elsewhere, according to the needs of the war. A visit to the Air Force has been led at last.

All this is for very far from 1935. Those were long days for the Air Force. Then, the United States ranked fifth in airplane strength among the seven great powers. The order, as it stood on Jan. 1, 1935, is of interest: France, Britain, Soviet Russia, Italy, United States, Japan, Germany. There were already

indications that 1935 was to bring not some moderate surprise in world aviation. Six of the seven powers were making rapid strides in an international race for supremacy in both commercial and military aviation. Germany and Russia emerged as serious contenders. (Text on page 302)



Fig. 3. So-called "medium" bombers are not very largely in American concept of long-range air warfare. Having range and striking power comparable to most modern heavy bombers, these high-speed, variable climb, multi-engine fighters, are especially adapted to operating on elements of surprise, then to meet the defense lines above in air-to-air combat, and to follow up on the ground, day and night. Various American B-25 Mitchell (left) and B-26 Marauder (above) are representative of this class of bomber.



Financial Outlook For the Aviation Industry

By H. L. FEDERMAN

THE AVIATION industry is well on its way toward making 1943 a very creditable year.

Aircraft production will be one of the key factors in securing victory for our arms—possibly this year—about certain. During 1942, accomplishments of the aircraft builders have been so heralded at every turn that the setting of percentage increases in terms of production, plant space, workmen, and in other terms, has lost something of its former significance.

It is well, however, to maintain a proper perspective of the industry's growth. This can best be done by examining the dollar value of output in airplanes, engines, and propellers for the last seven years, as presented in the following tabulation:

1936	\$77,000,000
1937	125,000,000
1938	225,000,000
1939	275,000,000
1940	340,000,000
1941	725,000,000
1942	4,400,000,000

Goal for 1943 is double the number of pieces of 1942, and expectations are that a production value of \$16,000,000,000 will be attained. This, of course, if all necessary material and parts are obtained and if no labor shortage interferes.

In the face of the industry's astounding production performance, considerable amazement pervades as to the very behavior of aircraft equities. A few representative examples will illustrate the frustrating behavior of the industry as expressed by the market.

Table I shows how poorly aircraft stocks have fared since Sept. 1, 1939, the date of the outbreak of war, and up to the close of 1942.

For example, all four issues sampled made their highs in April or May of 1940 and established their lows in May or June of 1942. The present end of 1942 now puts very close to three losses. All issues were in a price by at least one half of their high marks.

This reflects has been a distinct surprise to those speculators, investors, and newcomers who peruse the market edition of the war books during the days of World War I when, for example, Bethlehem Steel skyrocketed to \$700 from \$50 per share.

Market experience at the time of World War I and actual current pro-

duction records of the aircraft industry have caused a strange anomaly to the recent decline which has been the lot of aircraft equities.

The simple and convincing explanation lies in the fact that there has been no profligacy in aircraft manufacture or in the expenditure of our resources of war. At least, not for long. If anything, the aircraft builders have turned over bookends in keeping their profits on war contracts at low levels and have been more concerned with turning out planes.

Full impact of taxes has had its effect on reducing aircraft profits to low levels. Further, the continuing process of constant reorganization has served to combine gains within groups.

All this has been fully discounted and of late there have been increasing indications of strengthening market values for aircraft issues. Considerable evidence for this action is found in underlying factors.

Clearer understanding of tax liabilities has recently caused spread rumors of previously extended armaments which will undoubtedly be borne out by the actual reports upon their release.

The tax lawyer was laid to rest with the passage of the 1942 revenue act. Scarcely a day had it been enacted when it was urgently proposed. It is true that new and onerous tax demands will be made as a result of the fiscal requirements of the current budget. The aircraft industry will carry its share,

but it is an established fact that the market never reacts to the same possibility, issue. It only need be recalled that it was the constant flow of "cash up" issues that kept pushing aircraft values to lower levels during the greater part of 1942.

Regardless of how large the new tax measure may be, it is surely that it will be meted in such form as to completely annihilate aircraft earnings. Moreover, the prospect of meeting a tax bill on long and intricate. First, the House Ways and Means Committee will conduct involved hearings and come up with an idea for a tax law. Then the Senate Finance Committee will try to get the bill for while, some three weeks will be consumed in conference. And after that the Senate and House, respectively, will be asked to accept a much-compromised measure.

Unless Congress changes its past habits, it will be many months before the 1943 law may be placed on the statute books. Until that time, it will be highly evidence and maneuvering to attempt to evaluate the full extent of the forthcoming tax bill on the aircraft industry.

For general purposes, certainly to a market writer, the tax question is known and fully discussed.

The process of constant reorganization, in many instances, is approaching completion and making possible estimates of earnings. While these projections are necessarily tentative and somewhat premature for 1943, there is a tendency for the optimistic side to be favored.

Actual operation of the contract reorganization law has been very encouraging, on the whole, to the aircraft builders. This was a very much misunderstood measure while at one time was highly suspect.

It may be recalled that back in April, 1942, the President signed Public Law 505, known as the Sixth Supplemental National Defense Appropriation Act, 1942. Among other things, it made provisions for the general reorganization program to assist, in any contract for more than \$100,000, a provision that the contract price could be renegotiated at a time when profits could be determined with more reasonable accuracy.

(Turn to page 822)

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TABLE I—MARKET RANGE OF
SELECTED AIRCRAFT STOCKS

	High	Low	1939	1940
Bethlehem Aircraft	48, May, 1940	40, May, 1942	40	40
Boeing Aircraft	48, Apr., 1940	35, May, 1942	35	35
Glenn L. Martin	48, Apr., 1940	35, May, 1942	35	35
Grumman Aircraft	48, Apr., 1940	35, May, 1942	35	35

Note: All prices adjusted to nearest dollar price.

TABLE II
BARNES'S STOCK AVERAGES

	Aircraft	500	2500	5000
Jan. 9, 1942	27.10	28.45	40	40
Jan. 10, 1942	27.10	28.45	40	40
Dec. 15, 1942	27.10	28.45	40	40
Dec. 17, 1942	27.10	28.45	40	40
Dec. 18, 1942	27.10	28.45	40	40
Dec. 19, 1942	27.10	28.45	40	40
Dec. 20, 1942	27.10	28.45	40	40
Dec. 21, 1942	27.10	28.45	40	40
Dec. 22, 1942	27.10	28.45	40	40
Dec. 23, 1942	27.10	28.45	40	40
Dec. 24, 1942	27.10	28.45	40	40
Dec. 25, 1942	27.10	28.45	40	40
Dec. 26, 1942	27.10	28.45	40	40
Dec. 27, 1942	27.10	28.45	40	40
Dec. 28, 1942	27.10	28.45	40	40
Dec. 29, 1942	27.10	28.45	40	40
Dec. 30, 1942	27.10	28.45	40	40
Dec. 31, 1942	27.10	28.45	40	40

Note: High bid 1942

Transportation In the Postwar Period



By A. N. KEMP

President, American Airlines, Inc.

Much of our country's influence of the peace conference will depend on the strength of our air transport system. And in the final analysis, the size and scope of that system will be determined by the people.

Transportation in the postwar period is a subject which is vital to all of us—to our industrial, economic, and cultural lives. Perhaps, more of all, the development of our nation will be vital to the role we will play among nations when the time comes for us to sit around the peace table with our victorious allies.

Change is a certainty. For change, despite the fact that it has often tested man's mobility and often has been resisted, has never been stopped. Today's changes, hastened by a war, are in high gear. Therefore the need is greater for the benefit of perspective. To avoid mistakes of commission or of omission, we must approach our future transportation problems in the light of history. A dependable evaluation of technological advancements must include an understanding of human nature. Man has two aspects, his measurable physical and his immeasurable mind/body. It is the latter that survives all physical changes.

All that has been learned of our physical world and of the forces of nature has been learned despite trials and tribulation and despite the testimony of man's nature. Man once thought the world flat because that is the way he saw it. His thought the sun moved around the earth, and that the earth was stationary instead of moving much faster than man—but some did see the way he saw it. Man thought his sense of motion to be false, was only by land or sea—because that was the way he saw it. But what changes have been brought about from time to time as our world came out through the discovery of the facts about these matters?

Because air is available, it is difficult for man to "see" it. Yet, it is the use of air as a means for transportation, more than any other physical factor, which makes this a global war. By transportation we mean the movement through the air of any or all things, whether combat personnel, mobile guns, messages, or supplies. The freedom of

World War I could have all been due to the single state of California. But World War II is everywhere, actually or potentially, for the home and secondary reason that war is everywhere.

Perhaps the best illustration of our concept of today's changed air-world is the accompanying "air map" which has already aroused considerable comment. It is a polar projection map which reveals all destinations of the earth's land and water transport lines, showing nothing but the curves of planes in their proper locations. Once are the boundaries between our own states, once the map-fitter that separates our continental nation from the Atlantic and the Pacific and from Canada and Mexico. Once are those great barriers along our coasts—the oceans. These surface boundaries provide the clearest barrier to which is any post-war transportation phenomenon, because the proximity of planes, and their effective performance, are completely changed by the airplane.

It is true, man has been upon earth 12 million years. Always it has been necessary for him to combat the elements of nature. We can visualize the needs of primitive man as being primarily food, shelter, and protection of his body. Then came the knowledge that he could not remain rooted in one spot, as does a tree, and how true the immobility spells death to the human being. All through the years of man's existence upon earth there has been a compulsion to travel. Adversity as well as opportunity spurred man to seek and obtain those things necessary for his survival and growth. Transportation, therefore, is a very old problem. As man developed and his needs became more diversified and complex, he became increasingly dependent upon better methods of transportation. At various stages down through centuries, the mind of man has been challenged by new dimensions and conditions that change the meaning of time and relate the obstacles of space.

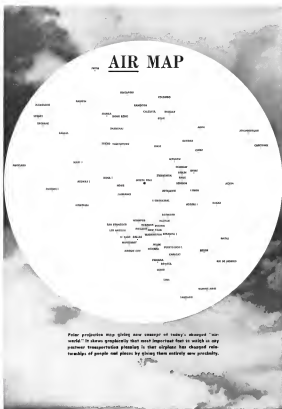
This process has been toward the speed of light for the longer days and a shorter mile.

In the path of irreconcilable change, man cannot remain neutral. Every special period of improved transportation has effected all men, both those who adopted and used the new and those who resisted and clung to the past. For the former it was a new dawn; for the latter, the beginning of the end. Our contemporary, postwar problem, however, is not a matter of choice in the mind of the individual. History will repeat. Man will go forward with it, some will go forward under it. In those respects, our age and our generation are no different from any of the countless ones in the world's past. And today we in America are faced with perhaps the greatest of all spatial transportation changes.

When this viewpoint is used, the editor of *Aviation* such a European report. That is because methods of transportation per se are not ends unto themselves; they are "the means toward some end." Time and distance all ways have become obstacles upon "the probability of one outcome" and upon all economic and cultural advancement. As each new method of transportation has made possible more than its predecessor, it also presented the volume of traffic it opened new horizons and created new problems. That, we believe, is what the National Resources Planning Board has in mind when it presents to the President that "the world's solution will never be achieved."

That still would be true even if we did not have victory today. But with today's and tomorrow's ships of the air as a new, third-dimensional factor, we believe the whole subject of transportation is in for the greatest change, in the shortest span of time, in all history. Therefore I shall not attempt to discuss indefinitely all forms of transportation in one postwar period—air, rail, motor, water, or pipe line. But let it be said that the individuals of this earth have spent countless centuries endeavoring to suppress old, and reverse new, methods of surface transportation. Consequently, the public has more or

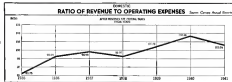
(Turn to page 417)



Polar projection map giving new concept of today's changed "air world." It shows graphically that most important fact is which is our postwar transportation planning is that airplane has changed role, timeliness of people and places by giving them entirely new proximity.

Some Air Transport Statistics Of Particular Interest

To Investors



To the Construction Industry

TENTATIVE CLASSIFICATION OF AIRPORTS SOURCE: AIRPORT DIVISION—CIVIL AERONAUTICS ADMINISTRATION		
CLASS		
1367	1523	<p>SMALL PRIVATE OWNER TYPE AIRPORT APPROX. FOR AIRCRAFT UP TO 1000' LONG FOR SMALL COMMUNITIES AND BUSINESS AIRPORTS USUAL COSTS: \$5000 TO \$10000</p>
543	700	<p>LARGER SIZE PRIVATE OWNER TYPE AIRPORT AND SMALL CITY TRANSPORT AIRPORT APPROX. FOR AIRCRAFT FROM 1000' TO 2000' LONG USUAL COSTS: \$10000 TO \$20000</p>
121	166	<p>PRESENT DAY TRANSPORT AIRPORT APPROX. FOR AIRCRAFT FROM 1000' TO 2000' LONG USUAL COSTS: \$20000 TO \$50000</p>
86	72	<p>LARGEST AIRPORT NOW IN USE AND THOSE PLANNED FOR IMMEDIATE FUTURE APPROX. FOR AIRCRAFT OF 2000' LONG USUAL COSTS: \$50000 TO \$100000</p>
2377	2453	

This presentation adopted from charts in Air Transportation Administration's booklet, "Safe Runway Facts". Data by request in AT-25707

AVIATION, February, 1942

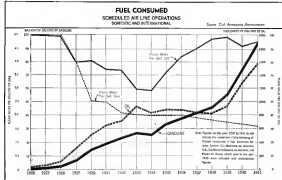
To the Transportation Industry



To the Radio and Electronics Industry



To the Petroleum Industry

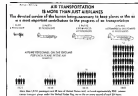


AVIATION, February, 1942

To the Lighting and Electrical Industry



To Engineers, particularly Air Forces Personnel



121

Trail Blazing in the Skies

1931

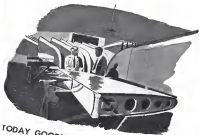


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1943



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Manufacturing Section of AVIATION

PRODUCTION
DESIGN • RESEARCH
ENGINEERING

More Wings for Aircraftmen
By Conveyor Production. Carl F. Loosen 126

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More Wings For Airacobras

... By Conveyor Production

By CARL F. LOZON

Assistant Works Manager, Bell Aircraft Corp.

Conveyor motion production lines—not more assembly lines—enable skilled women workers of Bell Aircraft Corp. to build complete wings in unprecedented numbers. Fixture design and layout cut production time

CONVEYOR MOTION ASSEMBLY LINES have been used to an increasing extent for almost two years by the aircraft industry. But, as the phrase implies, the work done on these lines for the most part consisted of attachment of parts and installation of electrical and hydraulic systems. To the

adaptation of available lines for the aircraft industry's use, Bell Aircraft Corp. was a pioneer, applying conveyor motion to its fuselage assembly lines in the spring of 1941.

Now, another important stride has been taken with respect to the use of conveyor motion lines, again by Bell

Aircraft. It is in the development of a system whereby wings for Army Airacobras are actually fabricated progressively on a belt-bolt power-driven conveyor. Bench work and machine work on subassemblies are accomplished parallel to the line and synchronized to its forward motion. This improvement is not something in the blueprint stage. It is actually operating—and very successfully.

There are absolutely no tool bars, power lines, cables, or connections on floor, desks, or work stands. Keep-bodies are provided, conveniently suspended from overhead lighting, to which drills, rivet guns, and all power-operated tools are attached at working height, thus eliminating work confusion and hazard, conserving rubber and control materials by greatly prolonging the life of bars and fittings. This also reduces workers' fatigue, resulting from stooping and lifting. All operations are planned for maximum simplification, each one clearly explained in oriented detail by words and pictures—right on the line—so the greatest operator can naturally go along.

Result: Efficient wing fabrication is accomplished by women operators (eventually 300 percent women—except for a few Indians who also may be replaced by women). And there are not scores with a background of experience and extensive training; many of them,

a few short weeks ago, were assemblymen, housemen, and school girls. Machine, engineering, planning, and an extensive industrial training program made this possible.

Arrangement of the wing department can be seen at a glance by referring to the second side of the fold-in across the top of this article. This department occupies an area of the Bell Airfield plant one extremely large bay and half of the adjacent bay. Here there are power-operated drag chain lines extending from a transfer area at one side of the building nearly to the opposite side. The smaller bay is given over to fabrication and assembly of the front and rear fuselages, the landing gear, trailing edge, and auxiliary lines, etc., etc., etc., accomplished before those parts join the production line.

Minimum of Obstacles

The whole layout of the wing line was so designed as to place a minimum of obstacles on or above the line and to require a minimum disturbance of the existing floor and foundation. The tools of the drag chain installation, transfer area, and track for the fixtures—these are largely explained in the drawings on page 8. Briefly, motion and guiding for the chains are housed in several pits at the power end of each line. A similar pit at the opposite end houses the sprocket for the return loop.



2 All electric and air-operated tools are suspended from transfer area, and are operating at whatever height required. Skilled operator of work unnecessary before. Keeps floor, work, and platform clear of tools and lines.

This has been made adjustable to take up slack.

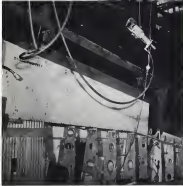
Transfer areas at other end of the line associate a slight depression in the floor. The track and chain supports are situated directly in the center of the floor without requiring any connection or disturbance of the flooring other than placement bolts. The drag and return chain ride in two channels, one above the other. However, since this is directly under the bow of the fixture it constitutes no hazard.

Fixture Features

Construction fixture fully rules, on floor wheels. They are all free rotating casters, but the full wheel is pressed and rolls on an inverted angle iron welded to the base plate beneath the chain support. The two outer wheels ride on flat plates, but on the center form and are kept in position by the locking device at the forward end of the fixture which engages the drag chain.



1 Typical work simplification development at Bell Aircraft. Difficulties reduce are used to distinguish areas covering identical operations. By referring to chart, operator can immediately determine correct tool and size.





3 Along station at line where work is high, bridge between platforms provides both movement parts rack and guard rails. Cabinet holds all tools required at station, ones on side dispense rivets. Note graphic operation sequence charts.

The fixture itself, illustrated on pages 126-128, incorporates many unusual features. The frame of the fixture is made of welded black iron pipe. The base is formed by an 8-in. main beam extending the full length of the fixture. This beam is crossed by a smaller pipe at the forward end, forming a T, with the two outer wheels mounted at the ends of the base. Rising vertically from the T-bar is a ladder to support the end plates which position the wing in the fixture.

Elements Lift Out of Way

Then, at the trailing end of the fixture is a shorter stepped block of 4 in. square. From the top of the stepped at an angle upward to the tip of the ladder is a long beam featuring the top of the fixture. This is a 3-in. pipe with a 5-in. flange welded to it. From this reinforced beam are suspended two mounting elements—the aluminum bracket locating fixture and the slot trailing edge holding device. Both of these elements

are lifted out of the way as soon as their function is completed.

A small fish plate for positioning the outer end of the main wing panel is hinged to the main beam at bottom, and a hinge at top rivets with a groove at the end of the aluminum bracket locating fixture with a removable pin locking them together. When the main wing panel is ready for attachment of the wing tip, the fish plate is swung down and out of the way on its hinge.

Spaced along the main beam are two padded supporting blocks which help carry the weight of the wing panel and protect the leading edge from damage when the panel is being removed from the fixture.

Sections of the ladder supports and the main beam with the cross of the T are reinforced with gussets welded in place. To each of the supports are welded down pads. To each pair of pads is attached a horizontal locating plate, accurately positioned by locating pins and fastened to the pads with two

normal hand bolts at either end. The bolt holes in the locating plates to which the wing is bolted in fastened are machined from the master fish plate.

After the pads are welded to the uprights of the ladder, the beam are ground to a plane that within 0.004 in. This was accomplished by attaching the grinder away directly to the ladder, thus assuring that all of the pads were ground on the same plane and to the same depth. The center of the pads were relieved, leaving only the narrow edges to be finish ground. The pads are drilled and tapped to receive the bolts, holding the end plates in position. Each wing line is broken down into 42 stations. At each station a specific set of operations is performed by operators assigned to that station.

Cabinets a Feature

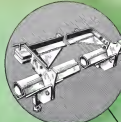
At the end of each station, beside each line, is a cabinet mounted to correspond with the station. It contains all hand tools, pins, pumps, etc., required to carry out operations specified for that station. This makes it unnecessary for any workers to carry tool boxes or hand tools to the line. It also helps disengage the number of tools kept and carried. The cabinet serves two other important functions. On one side is a row of ejectors containing various sizes of rivets needed for that station. They are equipped with tilt bottoms which release a convenient handful of rivets when these bottoms struck with the tips of the fingers.

The stand also provides a convenient rack for the photographic operation sheets which carry detailed instructions concerning the correct method of accomplishing each operation and the proper sequence of operations at that station. These operations instruction sheets are similar ones described in the article, Visual Production Training at Bell, by David G. Ferraro, which ran in the July and August, 1943, issues of AVIATION.

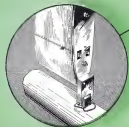
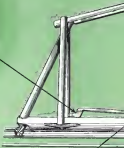
The sequence of operations at each station will be described briefly to demonstrate how the wing is built up in the fixture and finally completed and finished. Two of the lines are devoted to fabrication of right-hand panels and the other two to left-hand panels, so that they are completed in pairs at the end of the line.

As the fixture-dolly is brought down the station line toward the transfer car at the head of the line, the leading edge assembly (see Fig. 3) and the rear beam and spigots bearing assembly are positioned in the fixture. At Station 1, the outer halfhead and three intermediate halfheads are fastened in place (see Fig. 6). A dummy door is assembled to the front and rear beams with Calorpipe and pilot holes drilled (Fig. 8). Photos and filler strips are attached and drilled

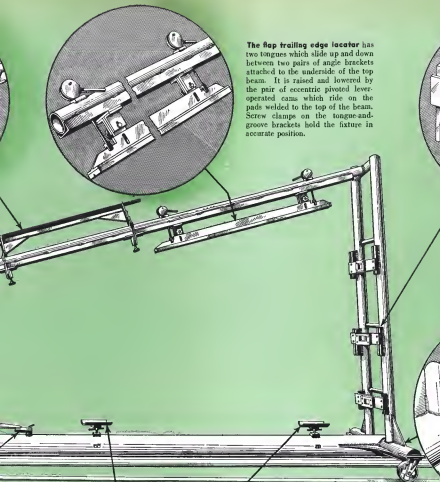
The aluminum hinge bracket locating fixture is constructed so that it may be released and swung up to rest on the top beam out of the way after its function is completed. In the down position, three padded bearings on the bottom plate of the locator support the three aluminum hinge brackets on the wing (see Fig. 14) and a slotted bar behind the brackets is used to position the trailing edge accurately riveted between the lower and top skins. Note where cleamps which lock locator in down position.



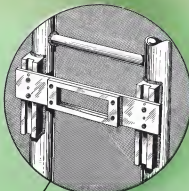
In the initial stages of fabrication, this end plate which aligns the outer halfhead of the main wing panel is raised to a vertical position. The angular extension enters the slot on the side of the aluminum hinge bracket housing suspended from the top beam and is locked in place with a removable pin.



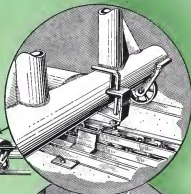
This shows the hinge detail of the outward halfhead fish plate as the panel position is seen from the rearward side of the fixture. Note contacts in the plate for strapping assemblies. Bolts are removed and the plate dropped down to the base of the fixture when the wing panel is ready for attachment of the wing tip.



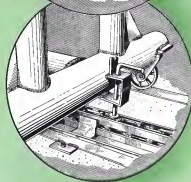
The flap trailing edge locator has two tongues which slide up and down between two pairs of angle brackets attached to the underside of the top beam. It is raised and lowered by the pair of eccentric pivoted lever-operated cams which ride on the pads welded to the top of the beam. Screw clamps on the tongue-and-groove brackets hold the fixture in accurate position.



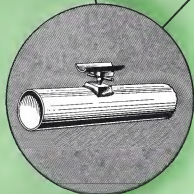
The end plates which position the inboard bulkhead of the wing panel are accurately positioned by means of locating pins and bolted to the pads welded to the uprights of the fixture with recessed-head bolts. This permits completed wing to be swung out of fixture without danger of damage from contact with protruding heads of bolts.



Two detail sketches show the fixture-locking device in engaged and disengaged positions. In the down position, the end of the bar engages a link of the drag chain and the fixture-dolly is pulled forward. This also positions the dolly laterally so that the free casters ride on the flat metal strips.



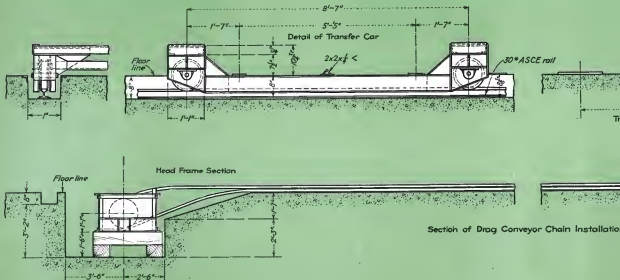
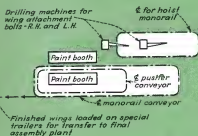
When the leading edge assembly is placed in the fixture, three supporting jacks, suitably padded, are raised into contact with the leading edge. As the wing assembly grows, they assist in supporting the increasing weight and also prevent damage to the leading edge when the wing is unbolted from the end plates and removed from the fixture.

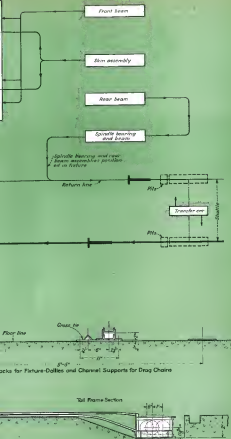


Schematic Diagram of Bell Aircraft Wing Production Lines and Detail Sketch of Installations

Note: Diagrams shown herein are schematic and bear no resemblance to the actual plant layout. Assembly lines move to the left and the return line moves to the right at a speed synchronized to accommodate all empty carriages from the slower moving assembly lines.

Women workers are trained for specific operations at individual stations and never leave the stations to which they are assigned. Pits at head and tail of each line are covered flush with the floor. Tracks and drag chain supports are covered a minimum of obstruction.





(Fig. 9). The dummy door is disassembled and chord members are drilled.

At Station 2, bulkheads are drilled, disassembled, cleaned of chips, then disassembled and reassembled with Cleco. After bulkheads are riveted, gas-tight covers are assembled and fitted.

At Station 3, holes are drilled for the gas-tight covers. The parts are disassembled, cleaned, then they are reassembled with set-up bolts and finally riveted.

The remaining bulkheads are assembled, drilled and riveted at Station 4. Plates and filler strips are assembled with Cleco against gun compartments. These are drilled, counterbored, and riveted (Fig. 9). Another dummy door is assembled to front and rear beams. Plot and spring holes for Dura fasteners are drilled. Dummy door is then disassembled and work supported.

At Station 5, holes previously drilled are opened up, chamfered, and counter-bored. Additional rivet holes are drilled through skin and spacers, then riveted. Spline plates and reinforcing plates and angles are assembled with Cleco and drilled.



At Station 6, skins are fitted to bulkheads, drilled, disassembled, dimpled, then reassembled and riveted.

At Station 7, the gas tank cover

assembly is fitted and drilled, disassembled, and counterbored. It is then reassembled at a later station after leak-proof fasteners are installed. Plates and spacers are assembled with Cleco and bolts, then drilled and counterbored. The oil cooler duct is also assembled at this station, drilled and disassembled. The bulkhead is counterbored for riveting the duct in place.

Station 8, skin is reassembled and partially riveted.

Station 9: Riveting of skin is completed, oil cooler ducts reassembled and riveted. The reconnection duct is installed and the hinge drilled through beams. The hinge is disassembled and dimpled. The beam is counterbored for the hinge, the hinge reassembled and riveted. Door parts are reassembled. Anchor nut and spacer assembly is drilled and riveted. Drain hole covers are installed.

Station 10: Channel nut assembly is drilled, counterbored, disassembled, cleaned, reassembled, and riveted. Drain systems are installed and riveted. Cleco collars are installed.

Station 11: Plates and films at gun compartments are riveted. Chord members at outboard end are riveted, then inspected. Partials are riveted to bulkheads and holes drilled for gas tank connection. Holes in web at liquidation opening are counterbored, cleaned, and inspected.

Station 12: Gas bag area and gun compartment is cleaned out and inspected.

Station 13: Gussets are placed as bulkheads and plywood floors installed.



5 First Step. Front beam-loading edge assembly locked into forms at intermediate point on delivery line. At end of line it is transferred to one of production lines and wing fabrication continues at Station 1.



C Rear beam and spar rib bearing assembly positioned in fixture. Attached to and plates with four bolts in shown in inset (left). At side end, tapered fish-plate of fixture is swung up and attached to bulkhead with bolts and holding plates (shown below).



in gas compartment. Skids and guides are fastened to bag assembly and supported. Choking pad and bag assembly is installed and impregnated. Flap/valve assembly is installed with clamps.

Station 14: Vent tube assembly, clamps, grommets, covers, covers, nuts, and other tube assemblies are installed and impregnated.

Station 15: Cover assembly, bag assembly, screws, grommets, fast straps, and access doors are assembled and installed. This is the outer assembly previously mentioned.

Station 16: Wheel well and landing edge assemblies are installed and a closing key fixed up in fixture. Additional bulkheads are installed.

assembly is installed and wing tip bolted in wing panel.

Station 26: Fuselage subord end of gas discharge cables and nut to length. Bolter clamps in cable. Tapered dummy pins and fit test. Assembly clamps assemblies are then installed.

Station 27: Gas controls are hooked up, operation of gas control checked, and gas is hand changed with dummy assemblies. Clamps and machine pins are removed and clamps reinstalled. Grommets and control cables are installed.

Station 28: Gas wiring is hooked up with flexible conduit and cable clamps. Block switches and limit switches are hooked up. Liquidometer is hooked up with plug and cable clamps. Identifier test light box is test, installed and connected.

Station 29: Refrigeration and rooming light wires installed and connected. A dip assembly is hand up and attached to the wing with bagging pins. The dip is hand up and frame adjusted with turnbuckle. Airframe assembly is installed.

Station 30: Trim tab cable is routed in control chain. Cover assembly and

inspection doors are fitted and installed. Station 31: Wheel well wheel assembly is installed and steps set for landing gear position. Control switch assembly is installed.

Station 32: Landing gear door assembly is installed. Station 33: Attaching link is connected to landing gear strut and checked for fit and action. All assemblies are checked and then checked up.

Station 34: All electrical installations and wiring are inspected and the panel is prepared for painting operation. Stations 37, 38, and 39 are connected with final inspection, "trim-up" operations, and the like.

Station 40: Wing panel is removed from the trim-up and transferred to a drag stand. From the overhead, a monorail which carries wing to drilling machine.

Station 41: A master fish plate drill fixture is hooked in subord bulkhead of wing and all holes are drilled simultaneously on a multiple drill. Drill holes are removed to size and drill fixture is removed.

Station 42: Wing is then transferred from the monorail to an adjacent over-

MANUFACTURING SECTION

head conveyor which carries wing through paint booth. Wing complete, a loop in conveyor and is then transferred to special wing tractors which carry completed wings to the final assembly plant.

Thus are wings for Army Air Corps delivered by women workers on a moving production line as moved from Bell Aircraft's wing department incorporate many proven tools and methods previously employed by the aircraft and automotive industries. But in its overall aspects, the wing fabrication here presents a brand new technique which marks a great stride forward in the achievement of high quality production of complex modern fighter aircraft.

See following for notes for re-assembly of plate fixture (No. 17) showing drill assembly methods.

7 Note how tapered fish-plate is locked into position with screw bracket. Bracing fixture shown. They are held together with a removable pin. Note, one of bulkheads are assembled between front and rear beams.

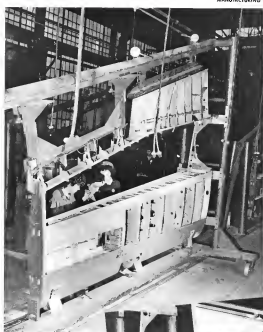




8 Droney door is assembled to front and rear beams with flanges. Operator then drills pilot holes and inserts bolts for flange between inglets. Droney door is then disassembled and work completed.



9 Plates and filler strips are positioned on both sides of rear, around gas compartments, and fastened with Clinch and bolts. They are then drilled, countersunk, and drilled.



10 Auxiliary beam and leading edge is positioned in place. This is secured by lowering on nut and bolt. Lead is put in place with four bolts (upper left) and three pins through upper beam. Auxiliary beam (lower right) is put in place in lead hole and secured on to base.

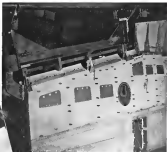




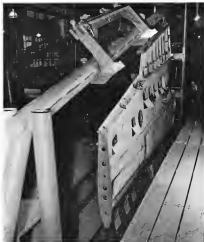
11 Overhead hoister lowered to hold trailing edge cantainer in place. Operators assemble all remaining bulkheads between wing beam and trailing edge auxiliary beam, then assemble channels and Clevis along to bulkheads.



12 Dummy flap is lined up with flaps and wire hoisted. Operator drills through flange, skin and beam, Clevis longer, then removes dummy flap. Flap are dropped in a general dangle and attached with a portable dangle.



13 Prior this is assembled to bulkheads with Clevis. Operator drills through wire skin, lower skin, and auxiliary beam, then Clevis. It is attached to alternate lower beam position auxiliary between lower skin and top skin of wing (beam top). Operator Clevis and 4000 (lower beam).



14 Flap wire removed from alternate lower beam and flaps using low line wing. End link plate drops in wing beam. Flap wire is moved to lower skin bulkheads, then top skin, extrusion, and lower skin are riveted together.

15 After winged flap plate is dropped, drill jig is held in bulkhead and bulkhead drilled (label lower right). Skin is moved back with bulkhead, cross wire and wire positioned, and wing top linked in wing panel.





16 Trailing edge flap hinge fixture is lifted and flap assembly completed. Aftmost is installed and locked up. Flap is then lined up and hinge adjusted (right).



17 Strut and wheel assembly is installed and struts adjusted for landing gear position. Wheel door is assembled and wing is ready for final inspection and "check up."

The B.F. Goodrich Airplane of the month

REPUBLIC P-47

Don't be fooled by armchair armchairists who talk about the superiority of other nations' fighter planes. Answer their comments with the facts about Republic Aviation's P-47. The "Thunderbolt," as it is appropriately known, has an effective ceiling of 40,000 feet, a super-charged 2,000 h.p. motor, unmatched speed and fire-power. No wonder the United Nations consider this Republic ship to be their ace-in-the-hole. Leading air-

craft manufacturers are stepping up plane performance with the help of B. F. Goodrich Silver-ton Tires, Expander Tube Brakes, De-Icers and Feed Shoes. This month, B. F. Goodrich nominates the Republic P-47 as Plane-of-the-Month.



B.F. GOODRICH RUBBER RESEARCH FOR THE

Aviation industry



Study of radial tire-growth as caused by centrifugal force!

IT HAS LONG BEEN KNOWN that tires tend to grow in radius as a result of centrifugal force, affecting the amount of clearance needed between a tire and its landing-gear mount. Today's inter-landing aircraft made this fact of greater importance to designers and builders of planes.

Mechanically, centrifugal force is known to vary directly with the square of the speed. Thus when speed is doubled—say from 20 to 40 mph—centrifugal force increases four times.

To measure the growth of a tire in inches, B. F. Goodrich engineers used a tire-testing machine, in which the road wheel, simulating movement of the ground beneath wheels during take-off and landing, was rotated at a speed of 140 mph. The tire mounted there was put on the swinging arm and brought into contact with the spinning road wheel.

A telescopic sight with a hair-line rule was focused at a fixed point on the tire's circumference so that any growth in the tire's radius could be accurately measured. The speed of the road wheel was varied from 140 mph down to 0 mph. Several sizes of tires were tested at those speeds.

Our engineers discovered that tire-growth varied only with the speed and very little with the size of the tire tested. In other words, at the same speed, a 36-inch and a 56-inch smooth contour tire grew about the same amount. The graph at the right makes this point clear.

Facts gained this way are of material help in designing landing gear as well as tests that will afford maximum safety for modern aircraft. The B. F. Goodrich, Co., Akron, Ohio.

MAKERS OF B. F. GOODRICH TIRES AND OVER 80 RUBBER AND SYNTHETIC RUBBER PRODUCTS FOR AIRPLANES



Test developed to measure radial growth

WHILE TIRES ARE IN MOTION!

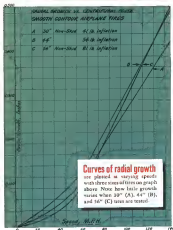
Clearance of a tire

is the offset and back type of landing gear strut is reduced when tire radius grows due to centrifugal force. (Observation of growth indicated by dotted line.) This has important bearing on landing gear design.



Sighting telescope

on rotating tire to measure its radial growth. Hair-line rule on telescope lens permits accurate measurement in fractional inches. B. F. Goodrich Brake Tester not used to simulate action of tires during take-off and landing. Road wheel rotates at controllable speeds up to 150 miles per hour.



In war or peace

B.F. Goodrich

FIRST IN RUBBER

CRASH PADS—Another adaptation of B.F. Goodrich molded sponge rubber is illustrated here. The cushioning effect of the crash pad protects the instrument panel. Again, the benefits of extra light weight, increased cushioning and extra strength play an important part in added safety and long life.

DE-ICERS

CRASH PADS

PROPELLER FEED SHOE

FUEL CELLS

RIVNUTS

TIRES

CRASH PADS—Another adaptation of B.F. Goodrich molded sponge rubber is illustrated here. The cushioning effect of the crash pad protects the instrument panel. Again, the benefits of extra light weight, increased cushioning and extra strength play an important part in added safety and long life.

—Propellers, too, are protected from ice with the B. F. Goodrich device that feeds the propeller blades with anti-icing fluids.

threaded rivet can be installed and headed, or upset, while working entirely from one side. Developed for attaching De-Iters, it is adaptable to other screw-on uses.

TIRES—For larger bombs or faster pursuits, B. F. Goodrich Aspland Silver-tone tires and tubes are engineered for the job.

And the leader the Veivers grew, the sweeter music they made to the song of age man. Horn—sure or less likely, namely—for the Nam "state," nestled in this western corner on the Hsiao-Hsueh. From near the same high-southern spot, made not on by Hsiao, Hsiao, Guo, and Guo, but Guo, but things collapsed, served to answer him from the New Under identity. For all the 25 years since the war he had worked to restore Xue—with himself as the head of the state. Not that the Hsiao Nation

To some people then, it wasn't surprising when the man put himself in a bind of the government. Nor was it very surprising when the out-time home of Narves began to resume its old-time appearance.

Suddenly, though, it all became very, very loud. The man made a terrible speech. These brutal, ruthless, war-mongering Belgians (the few who hadn't been shot or starved to death) had to quit persecuting the poor, downtrodden Germans or he'd stop at that table over there and the Germans would be free.

acted to me. For an airplane ride along with several other diplomats, the United Nations, he explained, was holding a small state conference, and double that man would enjoy attending it. He said that this took off. As they approached the French border the sky was liberally decked with huge airplanes bearing the emblems of the United Nations International Air Force. "And 25% of our military budget," said the man in the American uniform, "is taken to the length, verbiage of diplomacy." If you don't shut up, the other half, plus the really big balance will find you and you by mouth of the face of the earth."

Meanwhile, as the bombers headed south, the English Ambassador was into the seat next to him soon just as the sky again darkened with the wings of southbound fighter-bombers, also bearing the USAF markings. "So sorry not to be able to show you some

When the Czechoslovakian military attaché did into the next tent to this one and pointed to wing after wing of fighters, bombers, transports, and cargo planes, his eyes glinted and he said broadly, "Ah, if only I could give them the order, here and now!" The Soviet Ambassador was also present—but somewhat diplomatic. "One thing about airplanes," he said, "one don't take persons."

As this man stepped from the plane at the end of the trip he suffered to himself—in effect—"wade in this distasteful baptism. I've afraid I'll have to make my baptism in wet."

Later, as the American and English Ambassadors stretched before a film screen with their chairs, the Americans said dejectedly, "It was not won today without spilling a drop of blood, yet it probably means the end of no diplomatic career. Why? Because this man has helped start people everywhere."

about the cost of the Air Polms, and now the cost of sending them out today on their last road, insurance will also

"So, you have them, too," replied the English Ambassador, "I thought we might like to consider all the people who think we can actually use more

"So, there have always been the bad, and I'm afraid there always will be. We can only hope there will be efficient people who can realize what happened today, and who will insist on keeping the Air Police up to proper strength."



Maggiori's teaching as we felt, they assess the goodness



Helping to 'BRING 'EM BACK ALIVE'

Nothing in this war is more heartening than the large number of pilots and plane crews who come back alive from missions of extreme hazard.

Case after case has occurred where planes suffered terrible punishment, yet the pilots managed to bring them home. It is a tribute to the splendid skill of our pilots and the remarkable quality of our planes.

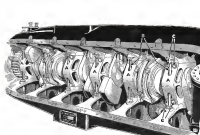
Vickers Hydromatic Controls are an important factor in the exceptional quality of American planes. These high pressure oil hydraulic controls stand a lot of knocking about...they're insensitive to shock and vibration. Yet they are instantly and easily responsive...dependable, accurate, easily adjusted.

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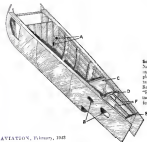
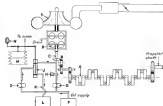
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SKETCH BOOK
OF DESIGN DETAILS

Main bearing supports of Vickers Rex 1000A engine, as provided in a study made by Raymond W. Young of Wright Aeronautical Corp., are carried (see "A") in heavily welded sections with wide flanges. A through-the-hole "B" with extremely finely polished finish and ground in both inside and outside conditions, passes through each main bearing and valveless main section, preventing localized cooling. Four stepped and stress loaded studs "C" secure each bearing cap. As in case of connecting rod ends, a deeply mounted head is used with addition of a spherical radius easing work.

Supercharger fluid drive of Vickers Rex 61A engine takes its power from crank shaft "A" through leak gear "B," helical drive shaft "C," and driving roller "D" which is splined to shaft. Impeller "E" (see 312) in the centrally mounted oil case and loaded by snail-like grooves "F" is oil film, fluid going through primary region driven pressure pump "G" with a slide valve at "H." A secondary region driven pressure pump "I" supplies oil under regulation from balanced in gas valve "J" with line "K" for return to oil pump "L." Sealed system "U" with adjustment "M" controls piston in balanced valve "E" and is responsive in action to changes in atmosphere density through air induction pump.



Structural analysis construction of plywood structure of South American tanker (see page 312) is illustrated in left. Supports "A" are for cables and those at "B" are for suspension plates. Bulkhead "C" shows part of load spread from top shell, beam part of assembly being attached at bottom. Remainder of load is distributed through bulkheads "D" and "E" through longitudinal members "F" which connect at deck beams for top of side. (Also see American's Steam Boat for Aug., Sept., Nov., and Dec., 1942).

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IN THE
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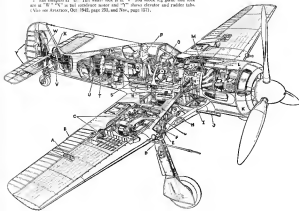
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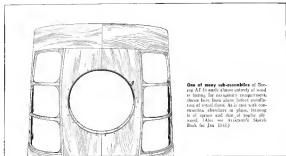
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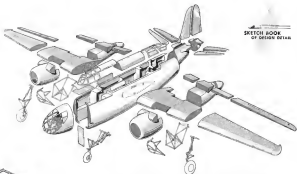
SKETCH BOOK
OF DESIGN DETAILS

Structural details of Peche-Wall 155A2 revealed in this cut-away illustration, as drawn from *The Aeroplane*, include following: Adaptor hinge bracket and support clearest seen at "A," with wheels self-alignable only on ground—at "B" and afterside control at "C," "D" is rear of two 20 mm. cannons, firing inside propellers; Landing gear rollers and brake hinge is at "E," separating tail wheel retracting cable "F" Landing gear retracting power is delivered by electric motor "G," with piston being checked by solenoid "H" flange cover "I" drops in when wheels come inboard; "J" is rear of two 30 mm. cannons firing through propeller; air- "K" is across-ship cooling including oil cooler; Two 550 machine guns are at "L" firing through propeller; Oil filter is at "M" and engine exhaust outlets at "N" "O" is at "O," while "P" is 30-mm. armor plate to protect pilot from rear; Adjusting mechanism for wheel's seat is at "Q;" Tail fin of 60 and 21 and one shown at "R" and glider's battery at "S;" Tail wheel retracting cable is at "T" and connects at "U;" Tail wheel lock is at "V" and shock leg guide and lock are at "W;" "X" is tail counterbalance wheel and "Y" shows elevator and rudder tabs. (See also *Aeroplane*, Oct. 1942, page 250, and Nov., page 157.)



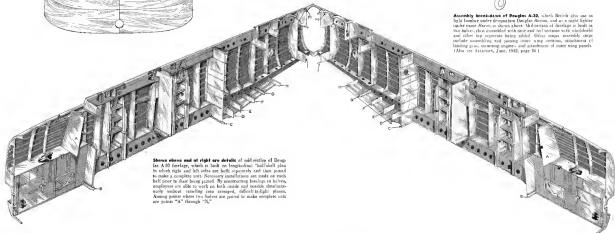


One of many sub-assemblies of Douglas A-32 is made almost entirely of wood to insure the maximum's requirements checked here from above before construction of metal sheet. It is cast with construction elements in place, forming in all cases and that of people's eye view. (Also see Skidmore's Sketch Book for Jan. 1942)



SKETCH BOOK
OF DESIGN DETAIL

Assembly breakdown of Douglas A-32, which Skidmore also uses as light fuselage under development Douglas A-32, and as a light fighter under name A-32, is shown above. Mid-section of fuselage is built in two halves, then assembled with rear and tail sections with cladding and other top separate being added. Other major assembly steps include assembling and joining outer wing sections, attachment of landing gear, mounting engines, and attachment of outer wing panels. (Also see Skidmore, June, 1942, page 16)



Shown above and at right are details of mid-section of Douglas A-32 fuselage, which is built on longitudinal "half-shell" plan in which right and left sides are built separately and then joined to make a complete unit. Necessary considerations are made on each half prior to their being joined. By constructing fuselage in halves, employees are able to work on both inside and outside simultaneously without retreating into cramped, difficult-to-light places. Among points where two halves are joined to make complete unit are points "A" through "G".

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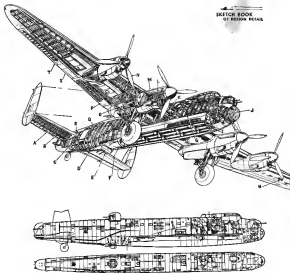
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Avro Lancaster is latest of British four-engine bombers, which have been used so effectively, not only in raids over Germany but Italy as well. Armed with ten Browning .500 machine guns in four gun turrets, it carries more of its. This cut-away illustration, exclusive *Time* flight, shows many of its structural details. Landing gear is shown from left, elevator linkage into its slots in "A" and elevator into slot in "B". A line and slot, on outside from inside, is in "C". Downward identification lights are located in "D". Vertical gas tank is shown in "E" and main ground line, which indicates where plane is in ground, is in "F". Principal longitudinal member

"G" supports bomb racks and main floor of cabin. Removable landing lights are shown in "H" and a venturi is positioned just below fuselage's nose-cone in "I". Antenna pole is located in "J". Flap for rotor is taken from engine motor through duct "K". "L" is an exhaust flange proper to one of four Pratt & Whitney Model A17 engines. "M" shows turbo-supercharger's constant speed propeller. "N" hydraulic landing gear mounting jack is in "O" and landing flap is shown in "P". "Q" is ammunition chute for very gun turret, and "R" is double release handle. Aft main gun and balance tube are shown in "S" and "T" respectively.

SKETCH BOOK
OF DESIGN PRINCIPLES

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Aircraft Terminology 1
Information, statistics, and advice concerning air aircraft terminology are included in four-page folder issued by Air World Standard Press Co., Rockford, Ill.

New Pens and Pencils 2
Circle 35. A-4, prepared by Herbert Frederick Pen Co., Tarrytown, N.Y., is a paper illustrated and designed catalog describing company's solid flow pens and pencils.

Buildup on Welders 3
From Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., comes new 16-page illustrated publication describing company's Fluorac & C welders. Designated as Welder #4225, it features 360 top industrial number for high speed, carbon arc welding on all types of heavy construction, and 300 amp portable reader for heavy duty work.

Shovelcups for Use 4
Zona for Industry, Shovelcups Division, is 16-page folder issued by General Radio Co., 50 English St., Cambridge, Mass. Details are included concerning use of Shovelcups and its instrument, clocks, valveless engine, etc., in aircraft industry.

Automatic Control Shaping 5
Recently issued bulletin, Depuchette Shaping Machine Control Shaping On a plane, describes how Depuchette machine machine tool used to need to be perfect standard shaping to do high speed automatic shaping. Bulletin is offered by Depuchette Universal Depuchette Co., 212 N. Milwaukee Ave., Detroit.

Connector Design and Methods 6
Compilation of aircraft connector design, test reports, installation procedures, and research identification articles is offered in new Periodic Literature Catalog No. A-33 issued by Ramo Engineering Co., 610 E. 113rd St., New York City. Included is description of Variants thermoplastic tubing.

Abrasive-Cut Tip 7
Chart prepared by Bell Machine Corp., Division of Western Co., 2700 N. 7th, is titled Abrasive Cut Tip Speed and Feed. Company's abrasive cloth "Goldgate" and its wheel's safety are pointed in use and described.

INFORMATION TIPS

Applied by performing tubes or other engineering devices. Instruments and apparatus are described.

Plastics Manual 12
Circular Plastics in War and Industry is title of comprehensive, profusely illustrated 16-page manual of specifications, properties, and applications of plastics, pipes, rods, sheets, films, foils, molding materials, photoresists, cement, belts, and gluing materials. Newly issued by Circle 35 Colloid Corp., New York City, has many more studies and data of the product literature.

Oil and Grease Tests 13
New tests on Oil and Grease is title of bulletin issued by Oil Free Mfg. Co., Chicago. Photos and diagrams illustrate 16-page test data on various mechanical applications. Tests, etc., of the product and have much value in research industry.

Meritor Tireless Airplane 14
The Meritor Tireless, Greenland, Meritor, England, offers special paper on attachment of Meritor tireless wheels through test results. Tireless test new volume of 35 to 40 are reported.

Temperature Instruments 15
Four new bulletins issued by Western Instrument Co., Chicago describe the company line of industrial instrument recording and charting instruments. With illustrated literature totals 24 pages.

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and interfering valve adjust foot speeds of future on slide, moving work toward cutting bar, also quickly retracting it when cutting is completed. Saw has spindle is actuated by 118-v motor, with three-speed pulley permitting changes in

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Shop Equipment & Accessories

Low-Angle Hack Saw27

From New Britain Machine Co., New Britain, Conn., is available low-angle hack saw frame suitable for numerous



shop jobs. Frame made equipped with a universal 10 in. blade. Blades made can conveniently be slid into frame, made equally well. Tool is 18 in. in length.—ATTENTION, Jan. '43.

model contains finger device adjustable to go off only under a force greater than any encountered during sharp drive and finish of several dig-lighting or rough hackings on lumpy fields.—ATTENTION, Feb., '43.

Sleeve Transfer Punch.....29

New aircraft worker's transfer punch, called the Capin Transfer Punch, is a drawing tool which a sleeve and with the end of



Anti-Fire Impact Unit.....28

Illustrated is impact switch, designed for Army and Navy, which automatically discharges several pounds of fire-fighting liquid carbon dioxide into engine compartment of combat plane in event of a crash. Developed by engineers of Walter Kubit & Co., Bensenville, Ill.,



this device mounted to template hole diameter. With interchangeable type for holes to 6 in. dia., punch is suited to transfer hole locations accurately to 0.001 in. Standard type are available for No. 3A, 4, 5, 6, 7, and 8 template holes. No. 4 in. Transfer Punch, Boston Plant, Ill.—ATTENTION, Feb., '43.

Portable Phase Lift.....30

Designed for aircraft service and maintenance operations at airports and assembly, work in plants, a new portable hydraulic phase lift is manufactured by Globe Bolt Co., Philadelphia, Penn.



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Blind-Side Burr Tool.....32

Based, new small setting tool announced by Everett Mfg. Co., Watertown, Conn., is designed for quick removal of burrs from blind-side holes

in Type A76, rail's entire lifting mechanism, cylinder, plunger, and reservoir tank, grasping unit and electric motor is mounted on base plate suspended independently from chassis. Under load, base firmly engages floor, while without load it rises free for wheeling about floor. Free "dwell" position of 30 in. power 40 is 21 1/2 in. plus hand-spring rise of 30 in. is a total of 51 1/2 in. Maximum lift capacity is 21,000 lb., and maximum load capacity is 10,000 lb. Power is provided by 5 hp., 220-v., 3 phase, 60 cycle motor.—Armstrong, Feb., '43.

Levator Relucts.....31

General Electric Co., Schenectady, announces new de to a motor wheel for fluorescent lighting of arc-cathode and induction. Relucts provides output voltage suitable for operation of the 6.6. Made of 1/2 in. diameter in T-602, PA-5 (inductor) line F-3 lamp. For induction lighting. By means of arc-cathode, there is also 3 in. 1.5 amp. output supply for each lamp.



to attach thin sheets. In operation, spring is compressed and burr removed in rivet hole, then spring pressure pulls back against thin sheet. One clockwise turn of tool reverses burr. Test bearing section on back prevents entry from outside, making no changing shape. Tests are for 1/2, 3/4, 1, 1 1/2, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100.

New Brake Unit.....32

Brake pressure cylinder, Model B-711, for use with hydraulic brakes on many



types of planes, has been designed by Budd Aviation Corp., Lancaster, N. Y. Unit weighs 23 lb., comes with installation instructions. Model B-711 is similar to front brake pedal position.—Armstrong, Feb., '43.

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Self-Guided Brushes 34

End brushes, designed to provide an end of power shaft and ball with self-centering, grooves, holes, and rollers, are made, ships, and pulleys, are marketed by O'Brien Mfg. Co., Cleveland. Brushes in photo (they're not too!) While cleaning brushes, cable and

shafts which run in cable-wound sub-stations—American, Feb., '43

Gear and Wheel Pallet 36

Added to line of Armstrong Day & Co., Chicago, are new Steadygrip rigid-gear gear and wheel pallets. Units are made in three sizes to suit for wide range of plant machines, lathes, and track maintenance jobs—American, Feb., '43.

Plastic Spray Gun 37

Deluxe Air Brush Co., Newark, N. J., now offers spray guns with black glass

NEW PRODUCTS

in bakelite. Strong plastic, providing lighter weight gun, is designed for good support strength with resistance to the sun, solvents, paint removers, etc.—American, Feb., '43



brush adapted to turning heads and cleaning hard-to-reach places, end loading brush (left) for cleaning and slotting from around most holes in airplane structures, and a series of three end brushes of varying sizes for jobs such as cleaning corners, plates, and cylinder heads—American, Feb., '43.

Adjustable Spacing Collar 35

Improved heavy-duty adjustable spacing collar for setting machine center line is manufactured by Duplex Duplex Mfg. Co., Minneapolis. Made in six sizes, collars have automatic internal



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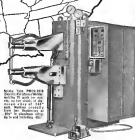


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Will Take Wood Jobs.....5-137

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Fighters

Bell P-38 Aircobra

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Designed with high-speed performance, the F4F Wildcat is a high-speed fighter. It is a high-speed fighter, capable of 30,000 ft. climb, 20,000 ft. top speed and 10,000 ft. per minute. It is a high-speed fighter, capable of 30,000 ft. climb, 20,000 ft. top speed and 10,000 ft. per minute. Top speed is in excess of 400 mph.



Lockheed P-39 Lightning

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Republic P-47 Thunderbolt

The largest and heaviest single-engine fighter in the world. It is a low-wing monoplane with a wingspan of 37 ft. 6 in. It has a maximum speed of 437 mph. It is the only fighter that can operate in the long range as a high speed fighter, with speed and maneuverability combined. Its action with the IJAP on the Atlantic is a fine example of its ability. It is also used extensively in the Pacific as a fighter, bomber, and reconnaissance plane.



Yough P-63 Corsair

The world's fastest single-engine fighter. It is a low-wing monoplane with a wingspan of 37 ft. 6 in. It has a maximum speed of 437 mph. It is the only fighter that can operate in the long range as a high speed fighter, with speed and maneuverability combined. Its action with the IJAP on the Atlantic is a fine example of its ability. It is also used extensively in the Pacific as a fighter, bomber, and reconnaissance plane.



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Boeing B-17 Flying Fortress

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AVIATION, February, 1945

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Douglas B-25 Bomber

Also in service with the Army is the B-25 Mitchell, also a bomber has been steady at action in aerial bombardment, including the Guadalcanal and Midway battles. Its accurate bombing, at the "low altitude" target performance, has been half of which holds up and other down to, and up to 4,000 ft. A 2,000 hp. engine is mounted centrally, inside the fuselage, and the bomber can be flown over the water. The 1,000 hp. Wright Cyclone engine gives it top speed of 250 m.p.h. Range is 41 ft. 3 in. 1,500 ft. 33 ft. 3 in. height, 47 ft. 3 in. wingspan.



Douglas TBD Devastator

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North P-27 Mustang

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North American B-25 Mitchell

A fast, mid-wing monoplane, medium bomber with two turbo superchargers, the B-25 Mitchell has a top speed of 280 mph. It has a range of 1500 miles. It has a top speed of 280 mph. It has a range of 1500 miles. It has a top speed of 280 mph. It has a range of 1500 miles.



Northrop B-35

A low-wing, semi-cantilever, ground bomber, the B-35 is powered by four 1800 hp. Wright Cyclone engines. It has a top speed of 280 mph. It has a range of 1500 miles. It has a top speed of 280 mph. It has a range of 1500 miles.

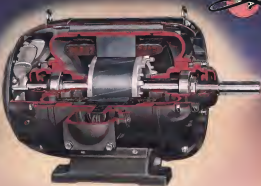


Boeing B-24 Liberator

A medium bomber, the B-24 Liberator is powered by four 1800 hp. Wright Cyclone engines. It has a top speed of 280 mph. It has a range of 1500 miles. It has a top speed of 280 mph. It has a range of 1500 miles.



ATLANTON, February, 1945



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Douglas C-53 Skytrooper

Called the Skytrooper by the Army. It is the 12½ lb. transport. It is 10 ft. 6 in. length 24 ft. 6 in. height 20 ft. 6 in. Landing weight 20,000 lb. Loaded to 20,000 lb. it carries 2000 lb. of cargo. The C-53 has a top speed of 200 mph and a full load range of over 1000 mi. in less than 110 ft. length 60 ft., and height 12 ft. 6 in.





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Commonwealth 190P

A highly maneuverable, low-altitude aircraft for superior observation and reconnaissance. It is used in coast of the Atlantic and in the Caribbean. Maximum speed is 200 mph.

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A highly maneuverable, low-altitude aircraft for superior observation and reconnaissance. It is used in coast of the Atlantic and in the Caribbean. Maximum speed is 200 mph.



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American



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Howard EGA

A two-place primary trainer with both forward and rear glider seats. Forward landing gear is of high strength to withstand against rough terrain. Engine, 100 hp. 100 hp. 100 hp.



North American AT-6

The famous "Texaco" model trainer, of which more than 3,000 have been sent to troops in Europe and Asia. It is a single-engine, high-wing biplane, with a top speed of 220 mph.

North American AT-6

Another popular model trainer, widely used in Europe, Asia, and Africa. It is a single-engine, high-wing biplane, with a top speed of 220 mph.



Ryan M-1

This is a Navy amphibious trainer. The top of the fuselage is hinged to open and admit a seaplane. Powered by a 100-hp. engine, it has a top speed of 220 mph.

Ryan M-1

A standard primary trainer, widely used in Europe, Asia, and Africa. It is a single-engine, high-wing biplane, with a top speed of 220 mph.



Ryan PT-35

A single-engine, high-wing biplane, with a top speed of 220 mph. It is a standard primary trainer, widely used in Europe, Asia, and Africa.

Ryan PT-35

A single-engine, high-wing biplane, with a top speed of 220 mph. It is a standard primary trainer, widely used in Europe, Asia, and Africa.



Taylorcraft L-3

One of America's best known. Eight years in service to the Army, Marine Corps, and Navy. It is a single-engine, high-wing biplane, with a top speed of 220 mph.

Taylorcraft L-3

A two-place primary trainer for the Army. Powered by a 100-hp. engine, it has a top speed of 220 mph. It is a standard primary trainer, widely used in Europe, Asia, and Africa.



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Productive **ONE . . .**



models. "MPL Ltd." Center, Center
2000, 1999, 1998, 1997, 1996, 1995, 1994, 1993, 1992, 1991, 1990, 1989, 1988, 1987, 1986, 1985, 1984, 1983, 1982, 1981, 1980, 1979, 1978, 1977, 1976, 1975, 1974, 1973, 1972, 1971, 1970, 1969, 1968, 1967, 1966, 1965, 1964, 1963, 1962, 1961, 1960, 1959, 1958, 1957, 1956, 1955, 1954, 1953, 1952, 1951, 1950, 1949, 1948, 1947, 1946, 1945, 1944, 1943, 1942, 1941, 1940, 1939, 1938, 1937, 1936, 1935, 1934, 1933, 1932, 1931, 1930, 1929, 1928, 1927, 1926, 1925, 1924, 1923, 1922, 1921, 1920, 1919, 1918, 1917, 1916, 1915, 1914, 1913, 1912, 1911, 1910, 1909, 1908, 1907, 1906, 1905, 1904, 1903, 1902, 1901, 1900, 1899, 1898, 1897, 1896, 1895, 1894, 1893, 1892, 1891, 1890, 1889, 1888, 1887, 1886, 1885, 1884, 1883, 1882, 1881, 1880, 1879, 1878, 1877, 1876, 1875, 1874, 1873, 1872, 1871, 1870, 1869, 1868, 1867, 1866, 1865, 1864, 1863, 1862, 1861, 1860, 1859, 1858, 1857, 1856, 1855, 1854, 1853, 1852, 1851, 1850, 1849, 1848, 1847, 1846, 1845, 1844, 1843, 1842, 1841, 1840, 1839, 1838, 1837, 1836, 1835, 1834, 1833, 1832, 1831, 1830, 1829, 1828, 1827, 1826, 1825, 1824, 1823, 1822, 1821, 1820, 1819, 1818, 1817, 1816, 1815, 1814, 1813, 1812, 1811, 1810, 1809, 1808, 1807, 1806, 1805, 1804, 1803, 1802, 1801, 1800, 1799, 1798, 1797, 1796, 1795, 1794, 1793, 1792, 1791, 1790, 1789, 1788, 1787, 1786, 1785, 1784, 1783, 1782, 1781, 1780, 1779, 1778, 1777, 1776, 1775, 1774, 1773, 1772, 1771, 1770, 1769, 1768, 1767, 1766, 1765, 1764, 1763, 1762, 1761, 1760, 1759, 1758, 1757, 1756, 1755, 1754, 1753, 1752, 1751, 1750, 1749, 1748, 1747, 1746, 1745, 1744, 1743, 1742, 1741, 1740, 1739, 1738, 1737, 1736, 1735, 1734, 1733, 1732, 1731, 1730, 1729, 1728, 1727, 1726, 1725, 1724, 1723, 1722, 1721, 1720, 1719, 1718, 1717, 1716, 1715, 1714, 1713, 1712, 1711, 1710, 1709, 1708, 1707, 1706, 1705, 1704, 1703, 1702, 1701, 1700, 1699, 1698, 1697, 1696, 1695, 1694, 1693, 1692, 1691, 1690, 1689, 1688, 1687, 1686, 1685, 1684, 1683, 1682, 1681, 1680, 1679, 1678, 1677, 1676, 1675, 1674, 1673, 1672, 1671, 1670, 1669, 1668, 1667, 1666, 1665, 1664, 1663, 1662, 1661, 1660, 1659, 1658, 1657, 1656, 1655, 1654, 1653, 1652, 1651, 1650, 1649, 1648, 1647, 1646, 1645, 1644, 1643, 1642, 1641, 1640, 1639, 1638, 1637, 1636, 1635, 1634, 1633, 1632, 1631, 1630, 1629, 1628, 1627, 1626, 1625, 1624, 1623, 1622, 1621, 1620, 1619, 1618, 1617, 1616, 1615, 1614, 1613, 1612, 1611, 1610, 1609, 1608, 1607, 1606, 1605, 1604, 1603, 1602, 1601, 1600, 1599, 1598, 1597, 1596, 1595, 1594, 1593, 1592, 1591, 1590, 1589, 1588, 1587, 1586, 1585, 1584, 1583, 1582, 1581, 1580, 1579, 1578, 1577, 1576, 1575, 1574, 1573, 1572, 1571, 1570, 1569, 1568, 1567, 1566, 1565, 1564, 1563, 1562, 1561, 1560, 1559, 1558, 1557, 1556, 1555, 1554, 1553, 1552, 1551, 1550, 1549, 1548, 1547, 1546, 1545, 1544, 1543, 1542, 1541, 1540, 1539, 1538, 1537, 1536, 1535, 1534, 1533, 1532, 1531, 1530, 1529, 1528, 1527, 1526, 1525, 1524, 1523, 1522, 1521, 1520, 1519, 1518, 1517, 1516, 1515, 1514, 1513, 1512, 1511, 1510, 1509, 1508, 1507, 1506, 1505, 1504, 1503, 1502, 1501, 1500, 1499, 1498, 1497, 1496, 1495, 1494, 1493, 1492, 1491, 1490, 1489, 1488, 1487, 1486, 1485, 1484, 1483, 1482, 1481, 1480, 1479, 1478, 1477, 1476, 1475, 1474, 1473, 1472, 1471, 1470, 1469, 1468, 1467, 1466, 1465, 1464, 1463, 1462, 1461, 1460, 1459, 1458, 1457, 1456, 1455, 1454, 1453, 1452, 1451, 1450, 1449, 1448, 1447, 1446, 1445, 1444, 1443, 1442, 1441, 1440, 1439, 1438, 1437, 1436, 1435, 1434, 1433, 1432, 1431, 1430, 1429, 1428, 1427, 1426, 1425, 1424, 1423, 1422, 1421, 1420, 1419, 1418, 1417, 1416, 1415, 1414, 1413, 1412, 1411, 1410, 1409, 1408, 1407, 1406, 1405, 1404, 1403, 1402, 1401, 1400, 1399, 1398, 1397, 1396, 1395, 1394, 1393, 1392, 1391, 1390, 1389, 1388, 1387, 1386, 1385, 1384, 1383, 1382, 1381, 1380, 1379, 1378, 1377, 1376, 1375, 1374, 1373, 1372, 1371, 1370, 1369, 1368, 1367, 1366, 1365, 1364, 1363, 1362, 1361, 1360, 1359, 1358, 1357, 1356, 1355, 1354, 1353, 1352, 1351, 1350, 1349, 1348, 1347, 1346, 1345, 1344, 1343, 1342, 1341, 1340, 1339, 1338, 1337, 1336, 1335, 1334, 1333, 1332, 1331, 1330, 1329, 1328, 1327, 1326, 1325, 1324, 1323, 1322, 1321, 13

Model: 9977 Lot: 600000
 604 Treadway Company Telephone
 10000 Treadway Park 100 Treadway
 10000 Treadway Park 100 Treadway
 10000 Treadway Park 100 Treadway
 10000 Treadway Park 100 Treadway

Each "AUTOMATIC" Approved Standard VICTORY Model will have the same time-proven features, quality materials, precision workmanship, sturdy construction, and guarantee under which the entire line of "AUTOMATIC" has already won wide industrial acceptance for highly efficient and economical materials handling.

"AUTOMATIC" is ready to serve you now as always without obligation through nationwide Material Handling Representatives who are fully experienced in the application of "AUTOMATIC" equipment. These men are listed in the classified telephone directories in the principal cities and industrial areas under "Trucks, Industrial" in many instances preparing and co-ordinating now with standardized equipment for war production will serve you efficiently for peacetime war activities.



MANUFACTURING FOR OVER 25 YEARS *Electric Propelled* INDUSTRIAL TRUCKS

AUTOMATIC TRANSPORTATION CO.

(3) WEST 87th STREET

CHICAGO, ILLINOIS



TRANSFER BALANT TYPE TENSILE

Model: 7-627 Fuel Type: 800 Brand: Caterpillar
TRANSPORTER Jack Type: Lift Fork: 5000000
Standard Fork Length to Max. Extension: 36" to 50"
Interchange in 2 Brand: Standard Jack Weight: 1500
Lbs. Fuel: 15 Lifting Weight from Low to
High Position: 375 1000 7-627 Hydraulic Fork
Capacity:

[illegible]

Model 7004 and 7014 400 Pound Capacity and Model 7044 and 7054 600 Pound Capacity TRANSPORTER Mail Item Type US Trade for Gold Platinum Mail Item Type Length is 14 1/2" to 17 1/2" Max Width is 36" and 30 1/2" Height is Low Profile is 7" P 11 (for full length) - 4 1/2" TRANSPORTER Platform Roll-out

NOTE: Some "AUTOMATIC" approved models can be furnished with optional equipment for operation in heavily contaminated areas. These models are available in the following configurations:

Model	Configuration
THS-1	Standard configuration
THS-2	Standard configuration with optional equipment
THS-3	Standard configuration with optional equipment
THS-4	Standard configuration with optional equipment
THS-5	Standard configuration with optional equipment
THS-6	Standard configuration with optional equipment
THS-7	Standard configuration with optional equipment
THS-8	Standard configuration with optional equipment
THS-9	Standard configuration with optional equipment
THS-10	Standard configuration with optional equipment
THS-11	Standard configuration with optional equipment
THS-12	Standard configuration with optional equipment
THS-13	Standard configuration with optional equipment
THS-14	Standard configuration with optional equipment
THS-15	Standard configuration with optional equipment
THS-16	Standard configuration with optional equipment
THS-17	Standard configuration with optional equipment
THS-18	Standard configuration with optional equipment
THS-19	Standard configuration with optional equipment
THS-20	Standard configuration with optional equipment

All models are approved types in accordance with materials and used as our production materials handle.

- | | |
|--|---|
| <ul style="list-style-type: none"> * Model: TLM-2, 6895 Pound Capacity
Low Lift, Hydraulic Platform Truck for S&B Transportation. * Model: TLM-3, 6895 Pound Capacity
Low Lift, Hydraulic Platform Truck for S&B Transportation and Palleting. * Model: TLM-3, 6895 Pound Capacity
Low Lift, Hydraulic Platform Truck for S&B Transportation. * Model: TLM-4, 6895 Pound Capacity
Low Lift, Hydraulic Platform Truck for S&B Transportation. | <ul style="list-style-type: none"> * Model: TSM-10, 10,000 Pound Capacity
Low Lift, Hydraulic Platform Truck for S&B Transportation and Palleting. * Model: TSM-15, 15,000 Pound Capacity
Low Lift, Hydraulic Platform Truck for S&B Transportation and Palleting. * Model: TSM-20, 20,000 Pound Capacity
Low Lift, Hydraulic Platform Truck for S&B Transportation and Palleting. * Model: CST-1, 3 Ton Capacity
Light Duty Forklift, Hydraulic Capacity for S&B Transportation and Palleting. |
|--|---|

Pilasters

British

Weathering Stone

[illegible]

Belinda Namukunda 25

The *Avanturier 23* has replaced the model program of the first model with two Kollsman-Stratos 23 engine, developing 575 hp at 21,000 r.p.m. Its top speed is up to 232 mph. Range 1,520 mi. at cruising speed of about 220 mph. Landing rolling in 3,000 ft. It is superior lighter than the earlier model. Arrangement to 232 hp 2000, comes to the top and up 300 mph, machine gun in the wings. Greatly improved in the same extent for the customer and delivered in 1940.



Palmer, Palmer

Another two new corn hybrids (shen-1 number), created by a Breeding Group No. 1 of 12-45 by a 2000-02. This place is better known for the type, having a mass of 45 g and a length of 40 cm. This seed is about 200 mg. According to one set of eight machine game in the wheat. No performance figures are based on this plant, but its productivity obtained at 250 mg (15,000) g/m² is a very good yield of 2000-02 g and a mass of 2,000 g with improvement is undoubtedly achieved in the next month.

[illegible][illegible]

VIETNAM, February, 1941

09-07-08-480 375-0000



**"Bigger and
More
Deadly"**

In the nightmares of the Nazis looms a huge winged thing, the very lines of which suggest its vast and lethal power. It is the super-bomber from America, described by military experts as "bigger and more deadly" than any ever before produced.

Bunting Bronze Bearings fly with many of the big bombers. In the powerful engines of these great destroyers, in the landing gear, tail gear, and at other important points are the Precision Bunting Bronze Bearings that are making history in bearing design and manufacture. The Bunting Brass & Bronze Company, Toledo, Ohio. Warehouses in All Principal Cities.

Bunting

地址: 上海南京路 100 号 电话: 021-23112222 电传: 021-23112222 电邮: 021-23112222

British

Supermarine Spitfire V[illegible]

Supermarket Spillings 19

This last model of the Synagogue is slightly smaller than the 15 m. monumentality of the Basilica of the Holy Sepulchre with its nave, transepts, and apse, with a high, barrel-vaulted ceiling. The apse is decorated with a large mosaic depicting the Last Supper. Principal differences in appearance in the interior seem to be in the floor and the frescoes, which are of a different style. The capital of the church is the same as that of the Basilica of the Holy Sepulchre.



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This is because, first, most players, when they follow the system, are still in the Provinces of Still by night. The second may be about 275 each, but while information has been released, I guess, because are the unexplained, including feelings, and the state of mind and the player played back up on the line as now, being used as a level-headed and after response (see above).



Blackburn, Rose

transmission, the same change as the flow, the flow differs from its predecessor through addition of a long-run power increment slightly greater than zero and λ is some constant. (Observe that in such a case, the flow is a geometric series and it has been already experimentally verified for both in gas samples of this type flow.) Determined by one known Powers, one can consider rather in gas delivering 500 kg by it, then 1000 kg, then 1500 kg, then 2000 kg, then 2500 kg, then 3000 kg, then 3500 kg, then 4000 kg, then 4500 kg, then 5000 kg, then 5500 kg, then 6000 kg, then 6500 kg, then 7000 kg, then 7500 kg, then 8000 kg, then 8500 kg, then 9000 kg, then 9500 kg, then 10000 kg, then 10500 kg, then 11000 kg, then 11500 kg, then 12000 kg, then 12500 kg, then 13000 kg, then 13500 kg, then 14000 kg, then 14500 kg, then 15000 kg, then 15500 kg, then 16000 kg, then 16500 kg, then 17000 kg, then 17500 kg, then 18000 kg, then 18500 kg, then 19000 kg, then 19500 kg, then 20000 kg, then 20500 kg, then 21000 kg, then 21500 kg, then 22000 kg, then 22500 kg, then 23000 kg, then 23500 kg, then 24000 kg, then 24500 kg, then 25000 kg, then 25500 kg, then 26000 kg, then 26500 kg, then 27000 kg, then 27500 kg, then 28000 kg, then 28500 kg, then 29000 kg, then 29500 kg, then 30000 kg, then 30500 kg, then 31000 kg, then 31500 kg, then 32000 kg, then 32500 kg, then 33000 kg, then 33500 kg, then 34000 kg, then 34500 kg, then 35000 kg, then 35500 kg, then 36000 kg, then 36500 kg, then 37000 kg, then 37500 kg, then 38000 kg, then 38500 kg, then 39000 kg, then 39500 kg, then 40000 kg, then 40500 kg, then 41000 kg, then 41500 kg, then 42000 kg, then 42500 kg, then 43000 kg, then 43500 kg, then 44000 kg, then 44500 kg, then 45000 kg, then 45500 kg, then 46000 kg, then 46500 kg, then 47000 kg, then 47500 kg, then 48000 kg, then 48500 kg, then 49000 kg, then 49500 kg, then 50000 kg, then 50500 kg, then 51000 kg, then 51500 kg, then 52000 kg, then 52500 kg, then 53000 kg, then 53500 kg, then 54000 kg, then 54500 kg, then 55000 kg, then 55500 kg, then 56000 kg, then 56500 kg, then 57000 kg, then 57500 kg, then 58000 kg, then 58500 kg, then 59000 kg, then 59500 kg, then 60000 kg, then 60500 kg, then 61000 kg, then 61500 kg, then 62000 kg, then 62500 kg, then 63000 kg, then 63500 kg, then 64000 kg, then 64500 kg, then 65000 kg, then 65500 kg, then 66000 kg, then 66500 kg, then 67000 kg, then 67500 kg, then 68000 kg, then 68500 kg, then 69000 kg, then 69500 kg, then 70000 kg, then 70500 kg, then 71000 kg, then 71500 kg, then 72000 kg, then 72500 kg, then 73000 kg, then 73500 kg, then 74000 kg, then 74500 kg, then 75000 kg, then 75500 kg, then 76000 kg, then 76500 kg, then 77000 kg, then 77500 kg, then 78000 kg, then 78500 kg, then 79000 kg, then 79500 kg, then 80000 kg, then 80500 kg, then 81000 kg, then 81500 kg, then 82000 kg, then 82500 kg, then 83000 kg, then 83500 kg, then 84000 kg, then 84500 kg, then 85000 kg, then 85500 kg, then 86000 kg, then 86500 kg, then 87000 kg, then 87500 kg, then 88000 kg, then 88500 kg, then 89000 kg, then 89500 kg, then 90000 kg, then 90500 kg, then 91000 kg, then 91500 kg, then 92000 kg, then 92500 kg, then 93000 kg, then 93500 kg, then 94000 kg, then 94500 kg, then 95000 kg, then 95500 kg, then 96000 kg, then 96500 kg, then 97000 kg, then 97500 kg, then 98000 kg, then 98500 kg, then 99000 kg, then 99500 kg, then 100000 kg, then 100500 kg, then 101000 kg, then 101500 kg, then 102000 kg, then 102500 kg, then 103000 kg, then 103500 kg, then 104000 kg, then 104500 kg, then 105000 kg, then 105500 kg, then 106000 kg, then 106500 kg, then 107000 kg, then 107500 kg, then 108000 kg, then 108500 kg, then 109000 kg, then 109500 kg, then 110000 kg, then 110500 kg, then 111000 kg, then 111500 kg, then 112000 kg, then 112500 kg, then 113000 kg, then 113500 kg, then 114000 kg, then 114500 kg, then 115000 kg, then 115500 kg, then 116000 kg, then 116500 kg, then 117000 kg, then 117500 kg, then 118000 kg, then 118500 kg, then 119000 kg, then 119500 kg, then 120000 kg, then 120500 kg, then 121000 kg, then 121500 kg, then 122000 kg, then 122500 kg, then 123000 kg, then 123500 kg, then 124000 kg, then 124500 kg, then 125000 kg, then 125500 kg, then 126000 kg, then 126500 kg, then 127000 kg, then 127500 kg, then 128000 kg, then 128500 kg, then 129000 kg, then 129500 kg, 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161000 kg, then 161500 kg, then 162000 kg, then 162500 kg, then 163000 kg, then 163500 kg, then 164000 kg, then 164500 kg, then 165000 kg, then 165500 kg, then 166000 kg, then 166500 kg, then 167000 kg, then 167500 kg, then 168000 kg, then 168500 kg, then 169000 kg, then 169500 kg, then 170000 kg, then 170500 kg, then 171000 kg, then 171500 kg, then 172000 kg, then 172500 kg, then 173000 kg, then 173500 kg, then 174000 kg, then 174500 kg, then 175000 kg, then 175500 kg, then 176000 kg, then 176500 kg, then 177000 kg, then 177500 kg, then 178000 kg, then 178500 kg, then 179000 kg, then 179500 kg, then 180000 kg, then 180500 kg, then 181000 kg, then 181500 kg, then 182000 kg, then 182500 kg, then 183000 kg, then 183500 kg, then 184000 kg, then 184500 kg, then 185000 kg, then 185500 kg, then 186000 kg, then 186500 kg, then 187000 kg, then 187500 kg, then 188000 kg, then 188500 kg, then 189000 kg, then 189500 kg, then 190000 kg, then 190500 kg, then 191000 kg, then 191500 kg, then 192000 kg, then 192500 kg, then 193000 kg, then 193500 kg, then 194000 kg, then 194500 kg, then 195000 kg, then 195500 kg, then 196000 kg, then 196500 kg, then 197000 kg, then 197500 kg, then 198000 kg, then 198500 kg, then 199000 kg, then 199500 kg, then 200000 kg, then 200500 kg, then 201000 kg, then 201500 kg, then 202000 kg, then 202500 kg, then 203000 kg, then 203500 kg, then 204000 kg, then 204500 kg, then 205000 kg, then 205500 kg, then 206000 kg, then 206500 kg, then 207000 kg, then 207500 kg, then 208000 kg, then 208500 kg, then 209000 kg, then 209500 kg, then 210000 kg, then 210500 kg, then 211000 kg, then 211



Resilient Paul DeNiro

Though religious in its secondary role, its major sphere of influence is the liturgical and the space in the Church of thinking. In the first appearance there, an equation is presented for 32 German places without a single anomaly. General use of reintercalation forms around the European year corrects large gaps in the liturgical performance by a craft of the new and useful. It is presented in a *Reichenberg, Werke III* of 1520 by a 2080 page of 10,944. Space is 101.4 cm. (width) 10.4 cm. and height 11.1 cm. 2,280 cm. (height). New 1942, p. 201.



Helen of Troy, U.S.A.

This woman, the face that launched a thousand American ships, she was so beautiful, so serene . . . and so relaxed and comfortable!

Not alone from the battles and the conquests and the voluminous billows of tent cloth. Daily her life was beset with the drudgery and the discomforts of the Gilded Age: The flat iron, the wood stove, the wash tub and the carpet beater, midnight and the coal grate, hammers and lathes, cabs that all these things have changed . . . miraculously and wonderfully changed.

And that's the theme of this story: *Change!*

For today the world is changing faster than ever before, and the first 5 years after this war will be equal to any 25 years of the past. Because this is true, we at Jones & Lamson have an important story to tell.

We were already 50 years old when Helen of

Troy was a girl. We began with the birth of the Machine Age in America, and even in the very birthplace. Many of the precision machine tools designed and developed by Jones & Lamson engineers during more than a century of the company's history have literally made possible much of America's industrial change.

Because of this background and reputation, Jones & Lamson engineers have actually been called upon by manufacturers — from the largest to the smallest — many thousands of times for counsel, service, or precision machine tools during a single year of this war!

If your business is manufacturing with metal . . . if you have problems today . . . and if you are looking ahead to the swiftly changing markets, products and methods of manufacturing after the war . . . Jones & Lamson engineers and service men can help you. They are at your call!



JONES & LAMSON

Universal Turret Lathes • Taper Automatic Lathes • Automatic Thread Grinders • Optical Comparators • Automatic Opening Die Heads

MACHINE CO., SPRINGFIELD, VERMONT, U.S.A.
Profit-producing Machine Tools

ATTENTION, February, 1945



Fuel Fuel Pump
General Engineering
in other parts

Partners in victory, pilot and plane stream earthward to silence hell's fury. A life and a conquest are entrusted to the performance of thousands of parts . . . parts that must be perfect. It's our duty here at home to see that every part is perfect.

In Aircraft Hydraulics, Fuel Pumps,
Air Pumps, Related Accessories . . .



PERFORMANCE POINTS TO

Pesco

FIRST

DIVISION BORG WARNER CLEVELAND OHIO



"HAPPY LANDINGS, SON!"...

You mother and I often think of you being up there alone in the sky. But we are never worried. It comforts us to know that the planes you fly and the equipment you use are the best in the world. And all during these months you have had the best of training that money could not buy.

So we're looking forward to the day, not so far off, when you'll come flying back to us and become a part of peace-time aviation—a great industry whose future is bright before today. There will be a job waiting for you! Meanwhile...—our love and Happy Landings, Son!

AIRCROX COMPANY, Division of

JOYCE Aviation, INC.
General Offices, 616 Michigan Ave., Chicago

PARACHUTE HARDWARE • COLLAPSIBLE WHEEL CHAIRS • EXACT AIRCROX COMPANY • JACKING AIRCROX KIT • TOW TARGETS FOR AIRIAL AND AIRCRAFT GUNNERY • SHOOTING SAFETY BELTS • AIRCRAFT SPINNER AND PROPELLER BLADES

Bombers

Avro Lancaster

Britain's greatest bomber, a multi-engine monoplan, with 1400 horsepower. Powered by four Rolls-Royce Merlin V-12 engines. A latest model now has 2400 horsepower. Top speed, 290 mph (470 km/h). Range, 3000 miles (4800 km). Length, 65 ft 2 in. Armament with four turrets and Thompson power turret in nose, six machine guns in the tail. Maximum 12,000 lb. bomb load. A 4000 lb. bomb, with 200 incendiaries, or six 2500 lb. bombs, with others.



APR 1945, Pictorial

British Mosquito TYP

This two-engine high speed long range fighter bomber has been an active service both in conventional warfare and in the strategic air warfare. It has an official top speed of 300 mph and a range of nearly 3000 miles (4800 km). The bomber is known to the Luftwaffe and the Luftwaffe command. It is powered by two 1500 hp. Bristol Taurus 111 engines. With three bombs mounted, 1000 lb. per engine. Range to 3000 miles, 4 in. climb to 3000 ft, 2 in. climb to 3000 ft, 2 in. climb to 3000 ft.



British Beaufort

A four-engine reconnaissance-bomber which has been used by the U.S. Coastal Command on a torpedo plane. It also serves as a medium bomber carrying a load of from 1000 to 2000 lb., depending on its mission. An important feature of its construction is the double fuselage, all of the dorsal fuselage section which is not part of the main fuselage. It is powered by four 1500 hp. Bristol Taurus 111 engines. With three bombs mounted, 1000 lb. per engine. Range to 3000 miles, 4 in. climb to 3000 ft, 2 in. climb to 3000 ft, 2 in. climb to 3000 ft.



By Northland Mustang

This is a new high speed bomber, two engine, with 1400 horsepower. Powered by two Rolls-Royce Merlin V-12 engines. A latest model now has 2400 horsepower. Top speed, 290 mph (470 km/h). Range, 3000 miles (4800 km). Length, 65 ft 2 in. Armament with four turrets and Thompson power turret in nose, six machine guns in the tail. Maximum 12,000 lb. bomb load. A 4000 lb. bomb, with 200 incendiaries, or six 2500 lb. bombs, with others.



AVIATION, February, 1945

**-WE'VE IRONED
OUT THE KINKS!**

A minute wasted here, a second there . . . added up, the sum total of wasted hours might mean the difference between "enough, on time" and "too little, too late." Production is speeding ahead now, because the dry time and material-wasters have been eliminated.

Takes, for instance, moisture damage during shipment and storage.

Constructors are getting parts and accessories from subcontractors . . . the fighting men are getting complete

tools, guns and planes . . . free of corrosion, rust or riddles through the use of Prottek-Sorb. And everything is ready for IMMEDIATE USE . . . upon delivery to the production line

or to the United Nations' battle lines!

Old-fashioned, time-wasting shuffling compounds used up vital man-hours. Prottek-Sorb does the job better . . .

FASTER. Its method of protection is so superior, so sure, so speedy, that its use has become the practice wherever men recognize progress.

THE DAVISON CHEMICAL CORPORATION
Industrial Sales Dept. • Richmond, Maryland

Prottek-Sorb

SILICA GEL is a DAVCO PRODUCT

PROTEK-SORB SILICA GEL is a chemically inert, non-toxic, granular material, capable of absorbing more than 40% of its weight in moisture. It provides the only instantaneous sound method of moisture damage prevention during shipment or storage of any product. Because it contains the secret of moisture damage . . . protects while the shipping container, line of demarcation during emergency is eliminated . . . products are almost ready to use when delivered . . . this is proved by manufacturer trial accounts.

Supplied in small cloth bags (shipped in straight cartons) for convenience and safety.

**PROTEK-SORB SILICA GEL MEETS
UNITED STATES GOVERNMENT
DESICCANT REQUIREMENTS FOR
DEHYDRATION PACKING, Type II**

Handley Page Herald

One of the first of the four-engine British "bombers" to go into service in the "Herald" has been used in practically all of the large scale tests on the new war production system. A prominent identifying feature is its tail fin, topped by the heraldic eagle of the Royal Air Force. The Herald is a four-engine, high-wing, all-metal aircraft with a wingspan of 120 ft. It is a very capable and fast machine. Maximum speed is 310 m.p.h. and it is in service with the RAF in a variety of roles. It is also used by the RAF in a variety of roles. It is also used by the RAF in a variety of roles.



Handley Page Hampden

Known as a "dive-bomber" to enemy forces in the early days, the Hampden has been largely superseded by the later Blenheim and Stirling. However, the Hampden is a very capable and fast machine. It is also used by the RAF in a variety of roles. It is also used by the RAF in a variety of roles.



Short Stirling

Long range heavy bomber, T in 1940. The Short Stirling is a four-engine, high-wing, all-metal aircraft with a wingspan of 120 ft. It is a very capable and fast machine. Maximum speed is 310 m.p.h. and it is in service with the RAF in a variety of roles. It is also used by the RAF in a variety of roles.



Short Sunderland

The hope of many a flying shipwrecked crew, the long range Short Sunderland is a four-engine, high-wing, all-metal aircraft with a wingspan of 120 ft. It is a very capable and fast machine. Maximum speed is 310 m.p.h. and it is in service with the RAF in a variety of roles. It is also used by the RAF in a variety of roles.



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Even the best priorities can't ensure immediate delivery on parts. But Westinghouse Aircraft Micarta in standard structural shapes is an available, easily machined, light, strong alternative—in many instances superior, for aircraft use, to the critical material it replaces.

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In addition to standard plate, Westinghouse Aircraft Micarta is applied in angles, channels, rods, arc bars and tubes. Full engineering data on Aircraft grades of Micarta, and how they compare in physical properties with metals and woods commonly used in aircraft manufacturing, is contained in a new Engineer's Handbook just published. If you have not received a copy, write for one on your company letterhead—today Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N.

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Westinghouse

AIRCRAFT MICARTA



Fighters

519

Sometimes referred to as the 3110-3, the single seat fighter is one of Russia's newest combat craft and is built in series, and very light construction as it has been found. It measures 27 ft. 6 in. in length, 11 ft. in height, and 11 ft. in wingspan. Empty weight 1,500 lb. Armament includes two 20 mm wing cannons, two 30 mm machine guns and two 50 mm machine guns in nose. The placement of guns gives the plane its unique point, which will be changed to conventional arrangement with the advent of spring.



Yak-1

Very little information has been made available on this remarkably modern design, designed before the war, but an airplane long referred to as the 210. A very clean, full featured, low wing, single engine, it is powered by a Tumansk 300, 1,500 hp engine with a maximum speed of 400 mph. It is heavily armored, and is armed with two 20 mm, while machine guns are not shown. It is in the same class and weight class as the 3110-3, about the same length, and with a span of 30 ft.



52-2

A two-place fighter-bomber which gave away many signs of having been developed from early Soviet American-built Eastern 3110-3. It is built on a completely independent design and according to a plan from the Russian Govt. has proved to be a sound, dependable design. It is a single engine, single propeller, and single seat fighter. It is one of the best fighters in the world. It is built on a plan from the Russian Govt. has proved to be a sound, dependable design. It is a single engine, single propeller, and single seat fighter. It is one of the best fighters in the world.

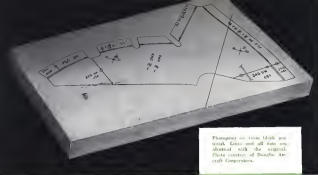


Bombers

52-15

A medium bomber carrying more than 10 tons of load. Designed by 42nd, who has a long line of the plane in his series, it is 31 ft. 6 in. in length, 11 ft. 6 in. in height, and 11 ft. 6 in. in wingspan. Empty weight 1,500 lb. Armament includes two 20 mm wing cannons, two 30 mm machine guns and two 50 mm machine guns in nose. The placement of guns gives the plane its unique point, which will be changed to conventional arrangement with the advent of spring.





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FIG. 2
Also from design board of American Airlines, this "fish" bomber which resembles a frigate to a ground attack craft. At the same point, some of the German modern fighters, all arm modern weapons, and most of them are equipped with missiles. The pilot and gunner are seated in a cockpit under the same canopy and the bombards are free to use in a compartment in the lower part of the fuselage. The maximum speed is between 1,500 and 2,000 ft. This 20-150 (Bombers) 1500 ft. fighters give a top speed of better than 200 mph. Some are approximately 10 ft. high and



TR-3
This is a four-angled head-on impact (caused by the truck). It is obvious, on all counts, landing gear or bird, with wheels parked in tandem. Distance was four to 11 Hognose/Birds 250 kg. Top speed, about 350 mph, range between 400 and 1,000 m. Signs are 200 ft. long. It is, from above, 2,000 m. North land, 2,000 ft. Above, within 10,000 ft. Above the line, though, but, long probably, reveal their face in Kamini's hole at about 100 m.



TR 48

One of the most unusual features of this fast engine high altitude booster is designed by A. N. Tsvetkov, is the novel retractable landing gear. The "Avalanche" retracts a wide track main landing gear—over 200 in. apart at launch, the inboard engine. To assist the drag resulting from these appendages, the craft has a top speed of approximately 200 mph. Four engines lifting 1500 lb. Thompson-burner engines drive the plane a better than 2000 ft. in 10 sec. at an altitude of 2000 ft. Open altitude is to be 4000 ft. TR 48 D.



This is a genuine "caterpillar" and not a machine of the type constructed which brought David Fairbairn's Composite Machine from Glasgow, to London to Warrington. One of the engines is now 3,000 ft. long and 10 ft. high. It is a V-type. Top speed is 20 mph. Average cruising is 20,000 ft., and range is 2,500 mi. at cruising speed of 240 mph. Of course the engine is a diesel, and the fuel consumption is 200 gal. per hour. It is the only of both colored and engine machines. Other equipment includes a 100-ton battery in the bow, 100-ton fuel tank, 100-ton fuel tank, 100-ton fuel tank.



Terminal plates—use of the most important parts in aircraft construction—are precision ground on Thompson Grinders, as illustrated by these photographs from one of the plants of the Douglas Aircraft Co. (right) and Boeing Aircraft Co. (below). Both plants take full advantage of the convenient adjustments on Thompson machines to obtain speed and absolute accuracy. Numerous other aircraft parts are similarly ground on Thompson machines in these and other aircraft plants. Bulletin list all features—write for your copy.

Terminal plates—use of the most important parts in aircraft construction—are precision ground on Thompson Grinders, as illustrated by these photographs from one of the plants of the Douglas Aircraft Co. (right) and Boeing Aircraft Co. (below). Both plants take full advantage of the convenient adjustments on Thompson machines to obtain speed and absolute accuracy. Numerous other aircraft parts are similarly ground on Thompson machines in these and other aircraft plants. Bulletin list all features—write for your copy.



A telegraphic description recommends a number of designs with different combinations of HRP and of different degrees. One of the designs shown is a top-down view of a map of the world, with a grid of lines and a central point. The design is described as being a top-down view of a map of the world, with a grid of lines and a central point. The design is described as being a top-down view of a map of the world, with a grid of lines and a central point. The design is described as being a top-down view of a map of the world, with a grid of lines and a central point.



Perhaps the most famous of the prison-designed places in the architectural history and design world is the Tennessee State Penitentiary, a large work on an area of two acres. The building and design of the Tennessee State Penitentiary was designed by James Earl Ray, who was sentenced to life in prison for the assassination of Dr. Martin Luther King Jr. in 1968. The building is a large, rectangular structure with a central tower and is known for its brutal design and harsh conditions.



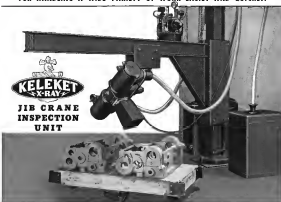
This is a five-bender version of the Transducer-Integrated (TI) design. The length of the benders is 10 ft. The length of the MPA is the same—approximately 6 ft. In length, 40 ft—only an extraordinary improvement in the cost aspect for the addition of piezoelectric bender-type five-benders, similar to those listed on the version 25-50. The five-benders have a length of 10 ft. The MPA is probably somewhat greater than the MPA of the version 25-50, with a weight of 500 lb. The MPA is made up of 1100 lb. of rods compared with the MPA of the version 25-50, with each piece of the bend bender version.

[illegible]

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Cargo-Transport

L-74B

With a rated 250 ft.—over 2 ft. less than the Douglas C-54—this transport-designed craft is one of the largest transport aircraft in the world. Originally built as a commercial transport, it had no accommodations for 60 passengers and a crew of eight. As a bomber it carried 10,000 lb. of bombs. The loading gear is conventional, the main landing gear is retractable, the wings being retracted to clear about 15 ft. in height. Its capacity as a bomber is limited by its capacity as a transport; its maximum gross weight is 130,000 lb. Maximum speed, over 400 mph at sea level.



Russian

PS-35

An all metal transport, the PS-35 is a single-engine aircraft. It has a maximum speed of 300 mph. The wings are retractable, the main landing gear is retractable, the wings being retracted to clear about 15 ft. in height. Its capacity as a bomber is limited by its capacity as a transport; its maximum gross weight is 130,000 lb. Maximum speed, over 400 mph at sea level.



PS-40

In this case, as in many others, the PS-40 has been used as a transport. It has a maximum speed of 300 mph. The wings are retractable, the main landing gear is retractable, the wings being retracted to clear about 15 ft. in height. Its capacity as a bomber is limited by its capacity as a transport; its maximum gross weight is 130,000 lb. Maximum speed, over 400 mph at sea level.



Fighters

Meiichi 202

This fighter is basically the same design as the 201, the most important change being addition of the Meiichi 202 100-600 engine. It has a maximum speed of 300 mph. The wings are retractable, the main landing gear is retractable, the wings being retracted to clear about 15 ft. in height. Its capacity as a bomber is limited by its capacity as a transport; its maximum gross weight is 130,000 lb. Maximum speed, over 400 mph at sea level.



Italian

Reggiane RE-2000

Single-engine fighter, very similar to the Reggiane RE-2000. It has a maximum speed of 300 mph. The wings are retractable, the main landing gear is retractable, the wings being retracted to clear about 15 ft. in height. Its capacity as a bomber is limited by its capacity as a transport; its maximum gross weight is 130,000 lb. Maximum speed, over 400 mph at sea level.



Reggiane RE-2001

Single-engine fighter of the same basic design as the Reggiane RE-2000. It has a maximum speed of 300 mph. The wings are retractable, the main landing gear is retractable, the wings being retracted to clear about 15 ft. in height. Its capacity as a bomber is limited by its capacity as a transport; its maximum gross weight is 130,000 lb. Maximum speed, over 400 mph at sea level.





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THE BLACK & DECKER ELECTRIC CO.
KENT, OHIO



Bombers

Cent. E-1076h

A typical Italian three engine biplane bomber, known as Cent. E-1076h, developed by the Fiat Co. 4 m. length, 34 ft. 2 in. height, 17 ft. 6 in. wingspan. Gross weight 34,000 lb. max. speed 275 mph. Top speed 250 mph. Altitude 20,000 ft. Service ceiling 20,000 ft. Gross weight 34,000 lb. max. speed 275 mph. Top speed 250 mph. Altitude 20,000 ft. Service ceiling 20,000 ft. Gross weight 34,000 lb. max. speed 275 mph. Top speed 250 mph. Altitude 20,000 ft. Service ceiling 20,000 ft.



Fiat CR-32BH

Two-engine medium bomber, the CR-32BH, developed by the Fiat Co. 4 m. length, 34 ft. 2 in. height, 17 ft. 6 in. wingspan. Gross weight 34,000 lb. max. speed 275 mph. Top speed 250 mph. Altitude 20,000 ft. Service ceiling 20,000 ft. Gross weight 34,000 lb. max. speed 275 mph. Top speed 250 mph. Altitude 20,000 ft. Service ceiling 20,000 ft.



Savoia-Marchetti SM-79

Another three engine biplane bomber, the SM-79, developed by the Savoia-Marchetti Co. 4 m. length, 34 ft. 2 in. height, 17 ft. 6 in. wingspan. Gross weight 34,000 lb. max. speed 275 mph. Top speed 250 mph. Altitude 20,000 ft. Service ceiling 20,000 ft. Gross weight 34,000 lb. max. speed 275 mph. Top speed 250 mph. Altitude 20,000 ft. Service ceiling 20,000 ft.



Savoia-Marchetti SM-81

Three-engine medium bomber, with four engines, the SM-81, developed by the Savoia-Marchetti Co. 4 m. length, 34 ft. 2 in. height, 17 ft. 6 in. wingspan. Gross weight 34,000 lb. max. speed 275 mph. Top speed 250 mph. Altitude 20,000 ft. Service ceiling 20,000 ft. Gross weight 34,000 lb. max. speed 275 mph. Top speed 250 mph. Altitude 20,000 ft. Service ceiling 20,000 ft.





Bombs for Breakfast

As the war goes, whatever goes up must come down. In the case of bombs, the all-important question is when.

By official count, a remarkably high percentage of the bombs released from Boeing Flying Fortresses came down where they'll run the most hell, with Axis hopes at sea, on battleships, cruisers, transports, destroyers, aircraft carriers on land, ship factories, arsenals, railroads, power plants, munitions dumps, docks, cranes and vital supply centers.

There are two things in particular that make the Boeing Flying Fortress a rugged glider on Frederick's sword list.

One is quality: the ability to fly a steady, straight course to the target in spite of enemy antiaircraft . . . and, by virtue of great flight-endurance, provide a perfect (and heavily armed) "platform" from which to let loose several tons of death and/or destruction. Score one for Boeing engineers.

The other is quantity: the rate at which these bombers are built under the accelerated short-flow multiple-line production system which results in maximum output per man, machine and unit of plant space. Score one for Boeing production men.

There'll come a V-day when Boeing engineering and "production" will turn from peeps of war to peeps of peace . . . from making the world wonder for reasons to making the seas, but would a bomb, brighter one in which to live.

For in designing and building Flying Fortresses, Stratofortresses,* glider-giants Clippers and other airplanes, Boeing continuously achieves new "records" in many fields of engineering: electrical, structural, metal-proofing, housing, radio, etc. It's the kind of "know-how" that helps to win wars, and will some day help in making peace—producing better and cheaper.

DESIGNERS OF THE FLYING FORTRESS • THE STRATOFORTRESS • THE AMERICAN CLIPPER

*The Stratofortress is now being produced by Boeing Aircraft Company.

BOEING

AVIATION, February, 1945

Figures

Boeing-Wall PW-137

An all-metal, two-engine, single- and two-place fighter. Construction is aluminum of fast and optimum strength. Powered by two Pratt & Whitney R-2800-10 1800 hp engines. Top speed 350 mph. Absolute ceiling 35,000 ft. Range of 1,500 mi. It is now being armed with two 50 mm cannons and four machine guns in nose. Later models have 360° gun rotation and the speed of 350 mph in 10 seconds of 100 mph. It is designed as a high-speed fighter in one and probably has a range of about 1,500 mi.



Boeing-Wall PW-138

A new heavy, two-engine, single-engine fighter, developed by the Boeing Westinghouse PW-138 is also constructed of aluminum, with two 50 mm cannons in the nose. It is powered by two Pratt & Whitney R-2800-10 1800 hp engines. Top speed 350 mph. Absolute ceiling 35,000 ft. Range of 1,500 mi. It is now being armed with two 50 mm cannons and four machine guns in nose. Later models have 360° gun rotation and the speed of 350 mph in 10 seconds of 100 mph. It is designed as a high-speed fighter in one and probably has a range of about 1,500 mi.



Boeing-Wall PW-139

First German single-engine fighter to use the Pratt & Whitney R-2800-10 1800 hp engine. Top speed 350 mph. Absolute ceiling 35,000 ft. Range 1,500 mi. It is now being armed with two 50 mm cannons and four machine guns in nose. Later models have 360° gun rotation and the speed of 350 mph in 10 seconds of 100 mph. It is designed as a high-speed fighter in one and probably has a range of about 1,500 mi.



Messerschmitt ME-109

The standard light single-engine fighter of the German Luftwaffe. First production in 1937. It has a top speed of 350 mph. Absolute ceiling 35,000 ft. Range 1,500 mi. It is now being armed with two 50 mm cannons and four machine guns in nose. Later models have 360° gun rotation and the speed of 350 mph in 10 seconds of 100 mph. It is designed as a high-speed fighter in one and probably has a range of about 1,500 mi.



他們來了

"...they have come"



Here's another Northrop technique

nose helping to speed
U. S. warplanes abroad

BEFORE a warplane reaches the final assembly line, hundreds of small metal parts must be fastened together into wings, engine nacelles, tail surfaces and other sub-assemblies.

Many of the small parts in these sub-assemblies are spot welded one to the other, and formerly this demanded tedious one-piece-at-a-time cleaning and preparation.

Not so, any longer. Today by a new Northrop-developed technique the whole sub-assembly is fastened together by what are called "skin-tights". The job of cleaning and preparation is all done at once, in a single quick bath.

Then, still held fast together, it all goes in one piece to spot welding machines—and comes out finished.

This new Northrop development is being

made available to other U. S. plane builders. So are other techniques by the Northrop group.

In return, other plane manufacturers inform Northrop of their new ways of building warplanes faster, with fewer man-hours.

And this business of trading techniques—of putting aircraft production on an "all-for-one-and-one-for-all" basis—is one reason that U. S. planes are now striking in such numbers on so many far-flung battle fronts. It's one reason oppressed people in many lands now look upward for deliverance—now are able to say in joy, "THEY HAVE COME!"



**NORTHROP
AIRCRAFT, Inc.**

Northrop Field, Northridge, California
BOMBER AIRCRAFT WAR PRODUCTION DIVISION, INC.

Northrop NC-117K

This latest all-weather was developed from models first built for the German Civil War. Powered by two Jumo 212 or Daimler-Benz DB 601 engines, it has a top speed of approximately 275 mph at 12,000 ft. Range, 1,000 mi. at 7,000 ft. max. load. Service ceiling 13,000 to 14,000 ft. Armament consists of one 1.5 inch and two 1.3 inch machine guns, mounted for the pilot, observer, and at 200 (instead of one 1.5 and one 2.0 inch) and one at the tail in the nose. Span is 34 ft. 6 in. length is 24 ft. 6 in.



Northrop NC-117

A mid-wing heavy bomber version. Engine span, 186 ft. length, 62 ft. 6 in. height. 18 ft. 6 in. wheel weight, 11,000 lb. Has only two engine nacelles. From one, four Mercedes-Benz 100-000, 1,500 hp. liquid-cooled engines run in each nacelle, according to the manufacturer. Maximum speed 350 mph at 20,000 ft. Maximum range, 2,000 mi. Service ceiling 20,000 ft. Bomb load seven tons. Submarines are the primary targets of this bomber. Dive-bombers' part subsiding on starboard side of nose, protecting rear gunner's post.



Lockheed JN-62 Duke

The latest two-place attack dive bomber. Span 42 ft. 6 in. height, 32 ft. 6 in. length, and Jumo 212 or Daimler-Benz DB 601 engines, 215 hp. at 12,000 ft. Landing speed, 400 mph; stall at 200 mph. Top speed, 350 mph. Service ceiling 13,000 ft. Cruise 1,000 mi. at 7,000 ft. Has two engine nacelles. From one, four 1.5 inch machine guns in each nacelle. From the other, one 1.5 inch machine gun in rear of fuselage. Wings retract and fold. This plane operates only where the air has been cleared by more powerful fighters.



Lockheed JN-60

Four-place medium day bomber, two-engine ship to replace the older planes. Span, 60 ft. 6 in. height, 42 ft. 6 in. length. Powered by two Jumo 212 or Daimler-Benz DB 601 engines, 215 hp. at 12,000 ft. Cruise at 250 mph. Max weight, 2,500 mi., and 100 ft. at 12,000 ft. Landing speed 400 mph. Stall at 200 mph. Service ceiling 13,000 ft. Cruise 1,000 mi. at 7,000 ft. Has two engine nacelles. From one, four 1.5 inch machine guns in each nacelle. From the other, one 1.5 inch machine gun in rear of fuselage. Wings retract and fold. This plane operates only where the air has been cleared by more powerful fighters.



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A Fastening Complete in One Easy Operation . . . You simply drive P-K Self-tapping Screws into plain, unthreaded holes. When they replace machine screws, you eliminate tapping, tap maintenance, and the problem of procuring screws

tags. When they replace bolts, you save the time-consuming interlocking bolts, phasing washers, and ransoming nuts. When they replace riveting and welding, expensive equipment is no longer required. When used in plastics, they end the need for costly inserts.

Changes to Self-tapping Screws Overnight . . . You can make the changes to P-K Screws with no interruption in production. No special tools or skilled help are required. Whether you are working with light or heavy steel, cast iron, aluminum, brass, or plastics . . . salvage those lost work-hours . . . question every fastening, now! Parker-Kalon Corp., 155-151 Varick Street, New York, N. Y.

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SELF-TAPPING SCREWS

SELF-TAPPING SCREWS FOR EVERY METAL AND PLASTIC ASSEMBLY

Give the Best Buy to the Assemblers

Bomber BG-24

An efficient long range bomber, the BG-24 is a four-engine, 11,000 lb. bomber with a top speed of 300 mph and a range of 2,000 miles. It is a four-engine, 11,000 lb. bomber with a top speed of 300 mph and a range of 2,000 miles. It is a four-engine, 11,000 lb. bomber with a top speed of 300 mph and a range of 2,000 miles.



Cargo Transport

Junkers JG-22

The old flag of the German Luftwaffe, the Junkers JG-22 is a four-engine, 11,000 lb. cargo transport with a top speed of 300 mph and a range of 2,000 miles. It is a four-engine, 11,000 lb. cargo transport with a top speed of 300 mph and a range of 2,000 miles.



Junkers JU-52

Four-engine troop transport of the JU-52 is a four-engine, 11,000 lb. cargo transport with a top speed of 300 mph and a range of 2,000 miles. It is a four-engine, 11,000 lb. cargo transport with a top speed of 300 mph and a range of 2,000 miles.



Junkers JU-251

This is the latest large transport to come from the production hands of the Junkers firm. It is a four-engine, 11,000 lb. cargo transport with a top speed of 300 mph and a range of 2,000 miles. It is a four-engine, 11,000 lb. cargo transport with a top speed of 300 mph and a range of 2,000 miles.



Bomber and Yacht B-222

A large, six-engine, high-wing bomber, the B-222 is a six-engine, 11,000 lb. bomber with a top speed of 300 mph and a range of 2,000 miles. It is a six-engine, 11,000 lb. bomber with a top speed of 300 mph and a range of 2,000 miles.



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Model 16 Bomber

A 10-engine, 7-place, heavy bomber. Span, 52 ft. length, 28 ft. Gross weight, 22,000 lb. Max. payload, two 2,000-lb. bombs. Max. speed, 220 mph at 10,000 ft. Equal wing load of 220 lb. sq. ft. Armed with two 12.7 mm machine guns in wings, one 20 mm cannon in upper turret, two machine guns laterally one fixed to tail, another swing in 34,000 ft. The wings are fixed with Japanese-type landing gear in retractable. This plane is also used as a freight carrier.



Model 17 Bomber

A two-engine, medium-range bomber, similar to the 16, but with slightly longer wings. Span, 32 ft. length, 22 ft. Gross weight, 20,000 lb. Powered by two Mitsubishi Model 17 14-cyl. radial of 222 hp. Max. speed, 220 mph. Cruising speed, 200 mph. Service ceiling, 20,000 ft. Max. payload, two 2,000-lb. bombs. Max. wing load of 140 lb. sq. ft. Armed with two 27 mm machine guns in nose, two 12.7 mm machine guns in wing, one fixed to tail, one swing in 34,000 ft. Equipped with Mitsubishi Model 17-100 mm rocket projectiles.



Model 18 Bomber

Another two-place, light bomber, intermediate plane. All metal, fixed landing gear, fixed wings, span, 32 ft. length, 22 ft. Gross weight, 15,000 lb. Max. speed, 220 mph. Cruising speed, 200 mph. Service ceiling, 20,000 ft. Max. payload, two 2,000-lb. bombs. Max. wing load of 140 lb. sq. ft. Armed with two 27 mm machine guns in nose, two 12.7 mm machine guns in wing, one fixed to tail, one swing in 34,000 ft. Equipped with Mitsubishi Model 17-100 mm rocket projectiles.



Type One Bomber

This is Japan's latest medium bomber. Last part of her series, it is a composite of the best American, British, and Japanese designs. No good purpose is to be lost, and no wasted ingenuity is involved. From this airplane, it is obvious to see a capable, well-armed plane.



Type 57 Flying Boat

A four-engine flying boat of the Kawasaki type, also showing some 200-hp. engines. Span, 52 ft. length, 22 ft. Gross weight, 22,000 lb. Max. speed, 220 mph. Cruising speed, 200 mph. Service ceiling, 20,000 ft. Max. payload, two 2,000-lb. bombs. Max. wing load of 140 lb. sq. ft. Armed with two 27 mm machine guns in nose, two 12.7 mm machine guns in wing, one fixed to tail, one swing in 34,000 ft. Equipped with Mitsubishi Model 17-100 mm rocket projectiles.



THE WORLD'S *Fastest* SHIPBOARD FIGHTER



Grumman F4F Corsair

Official Photo U. S. Navy

The "Corsair" is the most formidable shipboard fighter ever built! It has tremendous fire power . . . and it is big, powerful and fast. Its top speed is well over 300 miles per hour, but it can hit the patching deck of a carrier with the precision and grace of a gull . . . for its maneuverability is an engineering masterpiece. Navy pilots say it's the "sweetest" job they've ever handled . . . that the "Corsair's" controllability helps mightily to keep them on top of every situation.

Positive, rick-free controllability . . . with resulting high maneuverability . . . has been one of Fafnir's prime concerns since the end of World

War I. Then, in the design . . . in the engineering . . . and in the development of American-built planes, "Fafnirs on the controls" became a byword. Fafnir went along with the aircraft industry. Fafnir engineers worked closely and continuously with aircraft engineers, designers and builders in locating and controlling bearing problems as each new plane began its successive steps toward each "landmark" it established. This is why you'll find Fafnirs on many of the star performers today . . . for Fafnirs have proved their extra stamina, dependability and safety. The Fafnir Bearing Co., Aircraft Division, New Britain, Conn.

Send for copies Fafnir Aircraft Bearing Manual, you will find it an invaluable service guide.

FAFNIR
Ball Bearings
for Aircraft
Engines and Controls

Representative Aircraft Engines For 1943



Allison V-1710-19 liquid-cooled, V-type, 12-cylinder
1300 hp. at 2300 r.p.m.



Lycoming O-435-21A 7-cylinder radial
300 hp. at 2300 r.p.m.



Jacobs 7-cylinder radial
180 hp. at 2100 r.p.m.



Lycoming O-435 series 6-cylinder opposed
175 hp. at 2300 r.p.m.

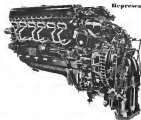


WHAT DO PILOTS THINK ABOUT?

Ask one, and you'll get this answer: "There's no time to think when you're in a scrap. You have to act!"

On America's fighters and bombers, Delco aircraft electric motors eliminate distractions during the moments of instant decisions and split-second action. They safeguard the flow of engine fuel on weapons and booster pumps... drive windshield wipers... and perform other vital functions. Delco Products' manufacturing experience has been applied to full measure to building dependable motors and equipment for the aircraft industry.

DELCO DELCO PRODUCTS DAYTON, OHIO **MOTORS**
DIVISION OF GENERAL MOTORS CORPORATION



Representative Aircraft Engines for 1943

Packard-Bell-Bryce V-1650 liquid-cooled, 12-cylinder V-type
1650 hp. at 2400 r.p.m.



Pratt & Whitney R-680-270 8-cylinder opposed
145 hp. at 2600 r.p.m.



Warner R-18 6-cylinder radial
175 hp. at 2600 r.p.m.



Deagler 12-cylinder inverted V, air-cooled
625 hp. at take-off.

The PROOF

is in the print!

PRECISION GRADING—TURQUOISE always gives you exactly the line you want. A separate laser formula for each of the 17 degrees guarantees grading that is as accurately and uniformly spaced as the marks on your rule.

REMARKABLE DURABILITY—"Electronic" graphics, refined down to particle size of one micron (1/25,000th of an inch) makes TURQUOISE lead so dense and durable that the longest line remains uniform in width and thickness.

OUTSTANDING STRENGTH—Eagle's patented super bonding process welds lead and wood into one inseparable unit which resists joint breakage. TURQUOISE stands up when you tear down, saving time & easing interruptions.

OPAQUE LINES—The dense, fine-textured lead in every TURQUOISE pencil deposits clean lines of such opacity that you get clear, sharp blackness direct from your pencil tracings.

FAST-FLOWING SMOOTHNESS—Every tiny particle of TURQUOISE lead is lubricated with zinc stearate, sealed in for permanent smoothness. Its swift, effortless strokes speed your work and save your energy.

TO PROVE IT YOURSELF SEND FOR FREE SAMPLE

Write today and we will gladly send you a TURQUOISE pencil or lead. Just name your supplier, the magazine and grade you desire.

EAGLE "CHEMI-SEALED"
TRADE MARK

TURQUOISE

DRAWING PENCILS AND LEADS



May 10, 1945

EAGLE PENCIL CO., 703 EAST 13th ST., NEW YORK

EAGLE PENCIL CO. OF CANADA, LTD., TORONTO

AVIATION, February, 1945

ARMOR



PROTECTIVE ARMOR PLATE FOR AMERICA'S FIGHTING AIRCRAFT

A Breeze Aircraft Armor Plate, manufactured by the Breeze Elastic Forming Process, is engineered in various shapes and sizes to meet designers' special requirements. Light in weight, this armor plate affords maximum protection to the vital parts of our fighting aircraft with the minimum sacrifice of speed and maneuverability. In quantity manufacture today, Aircraft Armor Plate supplements the Breeze line of aircraft accessories that are playing such an important part in the United Nations' drive to Victory.

BREEZE CORPORATIONS, INC.



NEWARK, N. J.

AVIATION, February, 1945

Let **PRESSTITE** *Aircraft* SEALING COMPOUNDS

Solve YOUR Aviation
Sealing Problems



★ Since their introduction to the aviation industry a short time ago, Presstite Aircraft Sealing Compounds have won wide acceptance by the aircraft manufacturers of America.

Especially developed for your industry—engineered to solve many of your problems—these Presstite Compounds provide fast, simple and long-lasting methods of sealing a wide variety of aircraft joints—especially in aviation fuel tanks. Their ease of application speeds production—proven adhesive qualities reduce maintenance, insure satisfactory sealing under all conditions.

All Presstite Sealing Compounds are available for immediate shipment.

No. 2D-126.4 Permagum

A non-cure, non-drying, non-hygroscopic, non-polymerizing, permanently elastic, rubberlike material used as a gasket or sealing material to seal large openings in covers or seams of fuel tanks. Not suitable in Avromatic Fuel.

Phynox Fuel Tank Sealer

For sealing light-weight plywood and plastic auxiliary airplane fuel tanks. Break—spray, or slash type—resists aromatic fuels.

Extruded Fuel Tank and Screen Sealing Tape

PRESSTITE

Sealing Compounds

Easy to handle because it extrudes from an cloth backing—varied widths

and thicknesses. Highly adhesive to metal surfaces even in presence of liquid hydrocarbons. Non-curing, non-polymerizing, resists aromatic fuels.

Extruded Tape Sealer for Synthetic Gums

Seals joints in aluminum as well as synthetic glass—especially designed for windshields, windows and gas tarrets. Stands up under extreme low temperatures. Seals joints tight against water, air, aircraft fuel, motor oil. Permanently elastic.

Fuel Tank Sealer

Break-on type for sealing integral tanks and for seams and joints in bolted tanks used for avromatic fuel storage. Will not slump up to plus 100° F., remains flexible at minus 90° F.

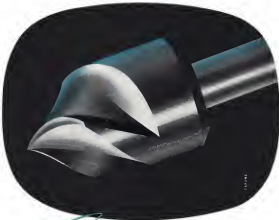
Cabin Sealer

For sealing over riveted joints in pressurized high altitude ships. Provides water and air-tight seal—withstanding temperatures from minus 90° F. to plus 212° F.

Zinc Chromate Compound

For Conditions A and B, Air Corps Spec. No. 1296, and Shaking Compound Air Corps Spec. No. 1595.

Let Presstite engineers help you to solve any sealing problem in your industry. Send us completed stated information on your needs and specifications today.



Splitting Microns

Answer of sub-micron accuracy in every product is given by the men of Schirillo—men who live, know and work with sub-micronal dimensions—the accuracy is measurable.

Accuracy of cutting tools and gages that are right from the start—for making specified tolerances—is given by the Schirillo individual inspection method—the direct and positive speed in war production.

Accuracy of customers in special tools is guaranteed by Schirillo foresight and engineering initiative.

Answer of minimum delay and rejection stands from Schirillo's incomparable mechanical features.

By examination—by comparison—and especially by use—you will discover that Schirillo standard and special cutting tools will improve the accuracy and efficiency of your production and that Schirillo gages, references and working gages will guarantee perfect interchangeability of parts.

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PRESSTITE ENGINEERING COMPANY • 3910 Chouteau Ave., St. Louis, Mo.



This shape is rolled from Alcoa Aluminum Alloy sheet in a single operation. Its use may take the place of a thicker extruded shape, thereby releasing metal and extrusion presses for production of vital war materials. Its production is one of many companies who are rolling forming under Aluminum-sheet shapes.

Many of these rolled-sheet shapes, being produced today for war products, are made of heat-treated Aluminum alloys to give them high strength. Often, the "as-rolled temper" strip is fed right from the heat-treating furnace to the forming rolls, before the metal can age-harden, thus avoiding distortion that might

arise if heat treatment followed forming.

Also shown above, in silhouette, are other rolled-sheet shapes. It doesn't take much stretching of the imagination to visualize a great variety of these Aluminum shapes used in numerous products. Exactly the right thickness and shape for strength and stiffness, but no more metal than is actually needed.

The economies possible with large quantity production are certain to cause these Aluminum rolled-sheet shapes to be adopted widely for all kinds of postwar applications. ALUMINUM COMPANY OF AMERICA, 2183 Galt Building, Pittsburgh, Pennsylvania.

ALCOA ALUMINUM



As the eighty PT boats of the U.S. Navy roll into action, they carry with them their own source of vital electricity—Lawrence Auxiliary Power Plants. These portable powerhouses, compact and light in weight, are designed to meet modern combat demands for a reliable flow of current to operate gas turbines, torpedo boats, radar, light, and galley hot plate. Lawrence Auxiliary Power Plants have been in action since Pearl Harbor; have given many thousands of hours of dependable, attention-free performance. Being produced today in ever-increasing quantities for aircraft as well as PT boat installations, Lawrence Auxiliaries are playing an important role in America's drive to Victory.



Lawrence Auxiliary Power Plant
Model 50C-3
Length 21½", Width 24", Height 15"
Normal continuous power output 5KW.
Maximum overload capacity 7½ KW.

Lawrence
AUXILIARY POWER

LAWRENCE ENGINEERING AND RESEARCH CORPORATION • LINDEN, NEW JERSEY

AVIATION, February, 1945

AVIATION, February, 1945

ASSUME RESPONSIBILITY FOR THE FIGURES GIVEN

<p>Submarine Steel Cable Transport Tractor Truck Wood Crate</p>	<p>W's - Wheel Wr - Winch</p> <p>Bearing P-17 is also being built under license by the British Royal Ordnance Corp. and Vickers-Armstrongs Ltd.</p>	<p>Consolidated P-24 is also being built under license by Avco Corp. and the North American Aviation Co.</p> <p>Curtiss SO4C is also being built under license by the Curtiss-Wright Corp.</p>	<p>naired Co., under the Navy designation BO1-C.</p> <p>Grumman F4F and TBF are also being built under license by the Grumman Corp. and the General Motors Corp. under the Navy designation BO1-C.</p>	<p>7205, respectively.</p> <p>Howard Aircraft Corp. also has a new trainer under development, designated the designations T-40 and T-41.</p> <p>Yough-Slovisky P40 is also being built under license by the Yough-Slovisky Corp.</p>	<p>Swenson Aircraft, Corp. also has a new trainer under development, designated the designations T-40 and T-41.</p> <p>Yough-Slovisky P40 is also being built under license by the Yough-Slovisky Corp.</p>
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Aviation's Foreign Airplane

BRITISH AIRCRAFT

[illegible]

GERMAN AIRCRAFT

Army Haplogroups G.A.M.H.		Age	Sex	Birth-Deathplace	CMPL	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Holms	A	1890	M	1890-1960	CMPL	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Holms	A	1890	M	1890-1960	CMPL	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Holms	A	1890	M	1890-1960	CMPL	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Holms	A	1890	M	1890-1960	CMPL	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Holms	A	1890	M	1890-1960	CMPL	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Holms	A	1890	M	1890-1960	CMPL	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Holms	A	1890	M	1890-1960	CMPL	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Holms	A	1890	M	1890-1960	CMPL	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Holms	A	1890	M	1890-1960	CMPL	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Holms	A	1890	M	1890-1960	CMPL	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Holms	A	1890	M	1890-1960	CMPL	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Holms	A	1890	M	1890-1960	CMPL	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Holms	A	1890	M	1890-1960	CMPL	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Holms	A	1890	M	1890-1960	CMPL	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Holms	A	1890	M	1890-1960	CMPL	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Holms	A	1890	M	1890-1960	CMPL	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80</																				

ITALIAN AIRCRAFT

[illegible]

JAPANESE AIRCRAFT

[illegible]

[illegible][illegible][illegible][illegible]

American Engine Specifications

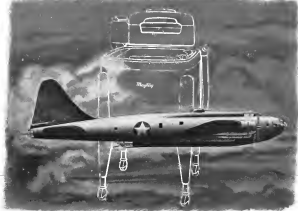
AVIATION does not mean responsibility for the future alone

[illegible]

American Engine Specifications—(Cont.)

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From Washing Machines to Precision Aircraft Parts

Austin proving it's Maytag "Know How" that counts

For nearly half a century Maytag has been a household word. To millions it stands for world leadership in domestic washing machines. When America called for war production, long before Pearl Harbor, Maytag entered and aided for tough and exacting assignment. One such assignment was the manufacture of hydraulic cylinders for combat aircraft. The role of the army is quite typical of American productive genius. By dint of hard work, long hours, and engineering skill, Maytag has redesigned, simplified, and succeeded in the building of these

devices. For twenty years Midea has held world leadership among washing machine manufacturers. It is typical of Midea: "know how" and perhaps spinoffs of their washers of the future, that in a few short months Midea has been able to attain an outstanding position in the field of air conditioners.

THE MATTAG COMPANY, NEWTON, IOWA

1883—*Par. Hall & Century*—1941

- ELECTRIC ACTUATING DEVICES FOR AIRCRAFT
- HYDRAULIC ACTUATING CYLINDERS FOR AIRCRAFT
- HEAT TREATED ALUMINUM AIRCRAFT CASINGS



The American Molybdenum Company, producer of millions of our aluminum weather coils, is now an important source of high-grade, heat-treated aluminum draft coatings.

Maytag

● 常用词汇



The Ph in the Cathedral...

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Because of the vast number of aviation products, it is not

feasible to make a separate classification for each one. If the product sought is not found in a separate classification the reader is asked to refer to the alphabetical index which lists in outline each product.

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FIRST U. S. power-operated gun barrels, giving our bombers strong protection against enemy interceptors. Martin is manufacturing power-driven barrels not only for Martin bombers but also for many other types of American aircraft.



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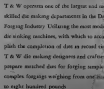
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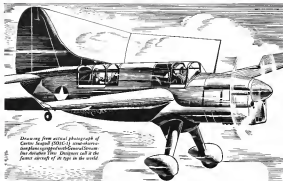
HYDRAULIC CONTROL SYSTEM: Cuno Auto-Klean, installed in high pressure line beyond the engine-driven pump, prevents damage or stalling of working parts in hydraulic control system.

GLYCOL HEATING SYSTEM: Glycol—from storage tank—passes through cleaned heater and rubber heat exchanger to provide hot water and glycol heat for heating. Cuno Auto-Klean filters glycol for heating. Cuno protects working parts, prevents accumulation on heat exchanger tubes.

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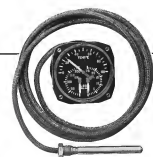
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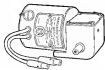


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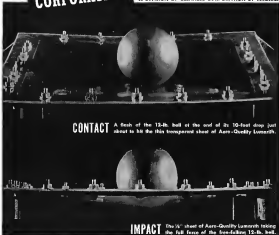
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CONTACT

A flash of the 12-lb. ball at the end of its 10-foot drop just about to hit the thin transparent sheet of Aero-Quality Lumarith.

IMPACT

The 1/2" sheet of Aero-Quality Lumarith taking the full force of the free-fallen 12-lb. ball.

The outstanding impact strength of Aero-Quality Lumarith plastics is made visible to the human eye by the Gjon Mili repetitive flash photographs. The 12-lb. iron ball (4 1/2" in diameter) is dropped from a height of 10 feet on 1/2" thick sheet of transparent Aero-Quality Lumarith plastic. The 12-lb. ball is shown hitting the Lumarith and bouncing in the air, leaving the sheet intact.

Transparent Lumarith sheets are sand-blasted or heat-formatted to make the windows of cockpits and tunnels for many United Nations planes and gliders. Aero-Quality Lumarith protects flyers against severe bombings.

Celaneese-Celluloid Corporation, 180 Madison Ave., New York City, a division of Celaneese Corporation of America. Representatives: Cleveland, Chicago, St. Louis, Detroit, San Francisco, Los Angeles, Washington, D. C., Lancaster, Montreal, Toronto, Ottawa.



REBOUND

Camera catches the heavy ball in two positions on the way down; then again at the instant of impact and finally, six flashes of the rebound. . . . In similar tests 1/2" Aero-Quality Lumarith transparent sheets have withstood the impact of the 12-lb. iron ball falling down from a height of 30 feet.

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... but this U-S-S Stainless Steel
collector ring keeps on "liking it"
at high operating temperatures



THE "specs" for a fighting plane's collector ring would read like a death sentence to most materials. They call for high corrosion resistance to withstand the sear of doped fuels — extreme heat resistance for the temperatures encountered in super-powered engines — fabricability for mass production — high strength-weight ratio for lightness — and good fatigue resistance to reduce repairs and replacements.

U-S-S 18-8 Stabilized Stainless Steel are meeting all these require-

ments, and many more. In war service on fighting planes such as the B-35 bomber, shown above, they have shown high ultimate strength at sustained operating temperatures, and produce no harmful oxidation scale at exhaust temperatures. Easy fabricability and weldability of stainless help speed plane production, too.

Collector rings are just one of dozens of aircraft applications where U-S-S Stainless is the ideal material — not only for parts subjected to ex-

traordinary heat, but also for many structural parts and control surfaces. Even, wearing conditions have not used the allowable uses of stainless to those aircraft applications where it is the only material that will do. But don't let this cramp your thinking when it comes to your designs for tomorrow's aircraft. Someday U-S-S Stainless Steel will be plentiful again. Why not start now to plan for giving your future designs the full advantage of this versatile material? Our engineers will be glad to help you.

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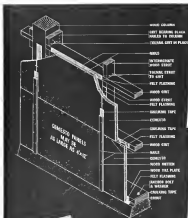


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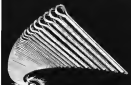
TODAY . . . While the United Nations recognizes Heller and his cohorts as a life and death struggle (Duke Road), with greatly enhanced functions and almost nationwide scope of operations, is directing its energies, equipment, manpower and management toward: 1) preparing and shipping American warplanes to the fighting fronts; 2) manufacturing and fabricating molded plywood aircraft cockpits; 3) providing engineering services for the Army Air Forces; and 4) other services to the wartime industry.

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The exclusive features of our Ferrule Terminal Resistors are so important that engineers everywhere acknowledge their superiority.

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The ends are open and the center inside diameter is completely free from obstruction of any kind—giving

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The resistance winding is silver soldered to each ferrule, insulating all possible trouble from loose contact connections.

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In addition to a complete range of sizes in this resistor, we have a large range of sizes in many other types of resistors and rheostats—with many other exclusive advantages. Please consult us before ordering, whether you need standard or special resistance service.



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AMERICAN airplanes of the war fly across the oceans, carrying fighting men and equipment to the battle fronts of the South Pacific, the Mediterranean, China, Britain—wherever there is need.

The dependability of our flying-fighting craft strikes terror to Nazi and Jap. While, here at home, the daily expending production of planes and arms enraptures everyone as to the final outcome.

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Everywhere Fenn will be back at the maintenance of building speed machinery, tools and equipment for power line industry. In the meantime they welcome inquiries from manufacturers and producers who have a production job calling for help.



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TO SPEED YOUR WARTIME



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Why the Smallest, Lightest Drills Are Better Than Ever

THOR'S U14A drills have always been the smallest, lightest, most powerful one-hand 1/4" electric drills available anywhere. Now, with eleven specific improvements in design and construction, they are better than ever!

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- Harder construction** of field case protects it against bumps and shocks.
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NEW BRIDGE BRIDGEVILLE, OHIO, U.S.A.
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This Tool Shopping Department under the supervision of an experienced tool engineer ensures that every tool in the plant's crib is in excellent condition.

GET ALL THE *Good* OUT OF *Good* Tools



This grinder located in a tool crib of a large aircraft engine plant is used for emergency sharpening and "touch-up" jobs.

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THE WORLD'S BEST TASTE



Photo by Charles Engel

*They Fly with their Boots on—
a million lbs. lighter!*



Fighter planes, bombers, cargo planes, trainers, gliders... all types of aircraft today "fly with their Boots on." And, because of this fact, they'll fly lighter—by a million pounds. For Boots Self-Locking Nuts—the important anchor and chassis types—are stamped from sheet metal.

Besides making America's planes a million pounds lighter, they save a million pounds in strategic metals.

Governments authorized, self-locking nuts... all metal... "lighter and enduring"... therefore better in operation and maintenance.

Today engine manufacturers are making extensive use of another Boots item—the "Rob-Tap," all-metal nut.

All of which means that we have better planes, and fighter planes... with less consumption of metal, when they fly with their Boots on.

FIVE REASONS WHY BOOTS IS A BETTER WAY



1. Lighter weight.
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3. Unaffected by oil, gasoline, mineral salt acids, or corrosive fumes.
4. Silences under high engine speeds, low temperatures and sudden temperature changes.
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THESE PLANES FLY WITH THEIR BOOTS ON

Bombing: Flying Fortress

Bombing: B-24 Liberator

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Bombing: B-24 Liberator

Bombing: B-29 Superfortress

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FOR ENGINE MANUFACTURERS

The Rob-Tap "nut" and Boots Self-Locking Nuts in the Boots Self-Locking Nut family are specially designed for engine applications. The Rob-Tap Nut does its job under highest temperatures, exposure to gasoline and other destructive elements.



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The Boots Self-Locking Nut is superior, all metal—vibration resistant vibration. The top (locking) section is displaced in a downward direction... locking threads are out of line with load carrying threads of lower section.

Upper section of both top section of nut is extended to engage with threads of bolt. A constant force is due on thread which holds nut firmly into position. Avoid thread play in clearance.

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Corsair TAKEOFF

With a thundering roar the Navy's Corsair fairly leaps off the carrier. Two thousand horsepower is the reason—plus twenty-six years of experience in designing first-line warplanes for America's fighting forces.

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Government Committee Plans Formulation Of Postwar Inter-Nation Airline Policies

First step toward international agreement on, and control of, world airlines after the war has been taken. Five government departments have formed a committee to formulate a policy which will guide the role which the United States is to play in the international air system.

Officials everywhere believe that aviation will be one of the major instruments of new world, national, and trade relations between the countries. There is considerable evidence of power politics—war, air, peace, and air—established between nations, a trading house for you (as we go there, you can come here) and when it was necessary to require very special permission for the entrance of one country to the controlled zone over another country.

Two of the main questions are: Should the United States achieve freedom of world air space, just as Canada and the United Kingdom have, or should it restrict all countries in so far as they desire to fly over our airspace? Further, if we achieve the latter, on what basis shall we propose to make reciprocal agreements with other countries?

Consequently, departments represented on the committee are War, Navy, State, Commerce, Office of War Relocation, and of course the White House, with the CAB responsible for carrying on both the main and sub-committee.

The problem is decidedly knotty, involving tactics and nearly all the points of international relations. One of the U.S. policy is formulated in accordance with other countries equally enough as international air conditions will begin with a world program, the goal.

The United States is now operating nearly all of the world transport airlines and will possess at the close of the war a much larger amount of transport equipment than any other country. This brings advantages on our part already

has the British planning their postwar international air system. Others, including Poland, France, Germany, and Italy, will want to regain their old routes.

AIF and Airline Win Collier Trophy for '41

To the Army Air Forces and the aviation of the United States went the Robert Collier Trophy for 1941 in a double ceremony in Washington on Dec. 20. Vice-President Whelan, acting in behalf of the President, presented the silver trophy to the Air Force, which it gives annually to recognize the greatest achievement in aviation in America during the preceding year.

Accepting the trophy for the AAF was Gen. H. H. Arnold, and for the airlines Col. Edgar H. Gurnell, of the Air Transport Association. Collier's Medal, which is given annually to the person or persons of the world "who have been most successful in the art of aviation," was presented to the AAF and the airlines.



AAF and airlines, which had together, won both trophies for 1941. Photo shows presentation to Vice-President Whelan (right) by Col. Gurnell of ATA (left) and Gen. Arnold, AAF, and

Planes and airlines witnessed the presentation.

"Recognition is given to the Air Force as well as to our private airlines who have done the fundamental planning which has made possible the rapid expansion of the post-war years," said the Vice-President in accepting the trophy to Gen. Arnold. "And it has been for the close cooperation in the 18 months before Pearl Harbor, which was the foundation for a world-wide air transportation system. It is extremely doubtful that our forces could have achieved the success it has in the past year of the war."

To Col. Gurnell, the AAF, "One thanks and appreciation to all of your aviation personnel—the Air Force, the airlines, and the devoted mechanics who operated in this field and thus were able to furnish the vital 'know-how' which has made world-wide air transportation a living, accepted fact."

The Vice-President also said that the "winning" contribution of the Army AIF and Navy AIF to the war effort was the production of the "know-how" of the airplane. And he then turned to the airlines of the world "who have been most successful in the art of aviation."

mentioned to the maintenance of a stable peace from Gen. Gurnell, and the Air Force Command were in the past, with which "that the people of the world together."

This was the 20th anniversary of the trophy, which was first awarded in 1921 to Gen. H. H. Arnold for his leadership in the development of the Air Force, the awards have been made annually except for a single year, 1940, during World War I.



Photo shows presentation to Vice-President Whelan (right) by Col. Gurnell of ATA (left) and Gen. Arnold, AAF, and

Photo shows presentation to Vice-President Whelan (right) by Col. Gurnell of ATA (left) and Gen. Arnold, AAF, and

Vought-Stearns Revision

Reconstruction of Vought-Stearns aircraft—whereby the Chance Vought division will concentrate on the development and production of multi-type aircraft, while the Stearns division will carry on development of the helicopter both as a military and commercial project—is announced by the United Aircraft Corp. Rev. 2 Stearns' division is concentrating on the development of Vought. For the present, both divisions, operating under the same management, are in a 50-50 partnership, jointly will occupy the existing office and plant facilities in Connecticut.

READING
TIME:
4 Min. 53 Sec.



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SUPPLIERS TO THE U. S. ARMY AND NAVY AIR
FORCES AND LEADING AIRCRAFT MANUFACTURERS

Job Stabilization Program Is Launched By Los Angeles Area WMC Committee

Jobs of both a civilian and military nature in the Los Angeles area were stabilized, effective Jan. 31 under a five-monthing plan sponsored by the Southern California Area War Manpower Committee composed of both management and labor representatives.

Regarding that workers in 34 designated major industries of essential work may not resign jobs unless they have a "certificate of availability" from the War Manpower Committee, the plan affects such major classifications as aircraft, aircraft parts, production of metal shapes and forgings and the several supplementary fields assigned to the extreme industry.

Among the management representatives of the committee is W. G. Twiss, Valley director of industrial relations.

The following three basic parts of the stabilization program are associated by W. G. Twiss, Southern California WMC director and area committee chairman: 1 An employer shall hire a worker only upon presentation of a WMC "availability certificate" furnished by the job applicant; 2 The certificate shall be issued to a worker only after such change of employment is in the best interests of the war effort; 3 The employer may not discharge or lay off any employee except upon such action as is determined by circumstances beyond the employer's control or when such action is in the best interests of the war effort.

Aimed at full utilization of management and manpower, the plan is expected to restrict under migration, eliminate excessive turnover of jobs, and stop "panhandling" of workers.

The program's operation will be assisted in at least 12 Employment Service offices. Availability certificates will be issued in quadruplicate and copy sent into the records of the job seeker's last employer for authorized WMC agent if the applicant has been unemployed, one going to the employer's records, and the other two being given to the work applicant.

When an employee is laid off, he receives two copies to his employer, who retains one, copy and sends the other to the WMC area office for statistical and control purposes.

An employee desiring to move to a new job may file his plan with his employer and or otherwise, depending upon, whether being required to remain at his current work. If no request of the certificate is submitted, a War Manpower Committee representative will review the case and the employee, his immediate agent, the current employer and the prospective employer all have a right to appear at the hearing.

Rating of the WMC representative may within three days be taken by any or all parties to an Area War Manpower Committee upon a committee which shall be mutually composed of labor and management representatives.



DOUBLE ACTION

Featuring "Double Action" for better and more in this first view of double assembly line at Consolidated's Tulsa plant. In foreground, #34 "Liberty" six engine combat helicopter—yes, they're now "line-produced" as well as "line-made." And line is kept up in constant, well-oiled "Liberty Express" transport. Picture shows only a small portion of plant.

WHEN ACCURATE TAXIING IS A MUST...



AERONCA LIAISON PLANES RELY on SCOTT

Maneuvering on roadways and other restricted landing areas calls for extreme skill of the pilot. Contributing to this skill, Scott Steerable Full-Swivel Tail Wheel Assemblies respond with positive action, guiding the Army's efficient Aeronca Liaison Planes to safer take-offs and landings. • • Built to take the abuse of emergency service, Scott Tail Wheel Assemblies combine exceptional lightness and strength. Each Scott Tail Wheel Assembly is static tested for shock resistance to guarantee dependable performance under the most exacting ground conditions. • • Scott Tail Wheel Assemblies are part of an ever-expanding line of special equipment for the air services—equipment which includes oxygen manifolds... oxygen regulators... brake pressure units... control wheels... stabilizer yokes... rudder horns... oileron bell cranks and Scott-Cast "40-E" aluminum alloy castings. Your inquiry on special equipment will receive prompt and confidential attention.

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PLANE PRODUCTION SPEEDED BY GIANT LIGHT REFLECTOR



White cement floor reflects 61% more light on the under side of bomber wings and fuselages...20% more light on vertical working surfaces. This type of floor used in Boeing, Consolidated, Douglas and North American plants.

LIGHT-REFLECTING FLOORS, made with Atlas White Cement, are being today as great reflectors and diffusers of light as costliest war plants. They chase shadows from production and assembly lines. According to tests by General Electric in Consolidated Alcoa's plant, this type of floor reflects 81% more light on under-side surfaces of plates than does the gray concrete floor in the same plant. Those tests also showed that the white cement floor produces 20% more illumination on vertical work surfaces than does the gray concrete floor.

By providing this increased illumination, light-coloured floors help make



**ATLAS
WHITE CEMENT**
FOR LIGHT-REFLECTING FLOORS

ers operate with greater speed and safety — select errors and spillage of materials. They sharpen the vision of workers who have defective sight . . . of older men and of new workers who are weak on an old machine for the first time.

White cement floors in aircraft plants for Boeing, Consolidated, Douglas and North American are showing the superiority over darker floors. As installations already made they have repaid their initial cost quickly. They can be cleaned and kept white simply and economically.

Write her a new book, "LOST FROM FLIGHT." It tells about the adventures

of better illumination and gives detailed information on the construction, maintenance and value of light-reflecting floors made with Atlas White cement. Universal Atlas Cement Company (United States Steel Corporation Subsidiary), Chrysler Building, New York City.

CONCERN: New York, Chicago, Philadelphia, Boston, Albany, Pittsburgh, Cleveland, Minneapolis, Duluth, St. Louis, Kansas City, San Mateo, Birmingham, Miami.

Universal Ads Cement Company
Cylinder Building, New York, N. Y.

Please send me a copy of new book, "Light
from the Past."

15. **Answer: D** The patient is exhibiting signs of hypoxemia, tachypnea, and tachycardia, which are consistent with a pulmonary embolism. The patient's oxygen saturation is 90% on 2L of oxygen, which is a concerning finding. The patient's chest exam is clear, which makes a pneumonia less likely. The patient's heart rate is 110 bpm, which is a concerning finding. The patient's blood pressure is 100/60 mmHg, which is a concerning finding. The patient's respiratory rate is 24 breaths per minute, which is a concerning finding. The patient's temperature is 38.5°C, which is a concerning finding. The patient's pulse oximetry is 90% on 2L of oxygen, which is a concerning finding. The patient's arterial blood gas (ABG) shows a pH of 7.35, a pCO₂ of 40 mmHg, a pO₂ of 80 mmHg, an HCO₃⁻ of 24 mmol/L, and an SpO₂ of 90% on 2L of oxygen. The patient's D-dimer is 1.5 μg/mL, which is a concerning finding. The patient's chest X-ray is clear, which makes a pneumonia less likely. The patient's ECG shows a sinus tachycardia, which is a concerning finding. The patient's CT scan of the chest shows a filling defect in the right lower lobe, which is a concerning finding. The patient's ultrasound of the lower extremities shows a deep vein thrombosis in the right lower extremity, which is a concerning finding. The patient's clinical presentation and findings are consistent with a pulmonary embolism. The patient's oxygen saturation is 90% on 2L of oxygen, which is a concerning finding. The patient's heart rate is 110 bpm, which is a concerning finding. The patient's blood pressure is 100/60 mmHg, which is a concerning finding. The patient's respiratory rate is 24 breaths per minute, which is a concerning finding. The patient's temperature is 38.5°C, which is a concerning finding. The patient's pulse oximetry is 90% on 2L of oxygen, which is a concerning finding. The patient's ABG shows a pH of 7.35, a pCO₂ of 40 mmHg, a pO₂ of 80 mmHg, an HCO₃⁻ of 24 mmol/L, and an SpO₂ of 90% on 2L of oxygen. The patient's D-dimer is 1.5 μg/mL, which is a concerning finding. The patient's chest X-ray is clear, which makes a pneumonia less likely. The patient's ECG shows a sinus tachycardia, which is a concerning finding. The patient's CT scan of the chest shows a filling defect in the right lower lobe, which is a concerning finding. The patient's ultrasound of the lower extremities shows a deep vein thrombosis in the right lower extremity, which is a concerning finding. The patient's clinical presentation and findings are consistent with a pulmonary embolism.

Parents

Company

Address

"Aircraft Tailor Shop" Buys Planes for Action

Dubbing them "aircraft tailoring shops" the OWS has now released a short memo study on the title published modification centers where standard mass-produced workpieces are altered to meet the varying custom requirements on the De-Bauer Trade.

There are a chain of these units operated by officers and aircraft factories under supervision of the AAF Materiel Command's Production Division as directed by the director at all aspects, but none have the Navy as well as Army—were serviced with the personnel commanding states added flying wings, increased bomb capacity etc. specifically called for by the article, desert to Iraqi operations placed.

Major General William H. Martin, commander of the 1st Marine Air Wing, said that the Marine Air Wing, which is based at Marine Corps Air Station Miramar, California, is the only Marine Air Wing in the world. The Marine Air Wing is the only Marine Air Wing in the world. The Marine Air Wing is the only Marine Air Wing in the world.

Exit 22 Airport Jct.

Construction on 25 airport projects in 12 states has been halted or curtailed by the WPS. In concerns war airplanes. All CAA-sponsored, 36 called for field developments involving a \$10,000,000 total expenditure while the other six involved new lighting fac-

cities in total about \$900,000. Airport work, valued at from \$500,000 to \$1,000,000, was stopped immediately at Reagan and Wilson. ARJ, DFW, and Ft. Worth City, however, continued and Boston La. Switcher Mini, Boston Mini, American Lake, N.Y. Gateway City, Wilson-Barnes Co., Greensboro, Tex., Montpelier, Ind.; Delta Lake, N.D.; and Delta Py and Atlanta, N.C.

New Army Pilot Training To Utilize CAA Facilities

Expansion of its program for combat-and-corridor pilot training is now announced by the AAF, which plans to use some 100 colleges throughout the country as training centers, checking the institutions according to their closeness to airfields. The contracts are to begin by April.

In this move, it is stated that maximum use of existing CAA facilities will be effected through Airport/CAA cooperation. Maximizing the new obligation CAA WTS (Wet Trekkende Services) requires the CPT Modification Network and

These will, it is understood, be two divisions in the new set-up. First, transport or instructor-work training for men deemed not suited for combat duty, among special qualifications courses for prospective tankists prior to their entrance into regular AAU schools. The number of men to receive the latter training will depend on facilities avail-



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Adapted from *Stacy, 1994*

UNITED STATES FEDERAL RESERVE BOARD

Boat starting second-year student, president of United Albatross Hauling Standard Propeller Division, is fast man mounted on glass at Berkeley Field, where first test run was made. Tule Groundwater employs several skiffs.

DIVIDE BY 6 AND ADD 35,000 Feet

TAKE the industrial generator shown here (in blue). Divide its weight—280 pounds—by six. Then give it special insulation and other features to permit its operation at 35,000 feet altitude or more. The result is the G-E aircraft generator—light, compact, high-altitude conditioned.

The two generators shown have the same capacity. The larger one is a standard type widely used in industry. The smaller is the aircraft generator used on most of our military planes today. It is built by General Electric, and by others to G-E designs.

This generator is an example of how electricity, and electrical engineering skill, are helping aircraft designers to increase power and to control weight. Before Pearl Harbor, an aircraft generator then considered light weighed 30 pounds, and had a relatively small capacity. Today, with power demands for individual planes great-

ly increased, the capacity of the generator has risen substantially, yet weight has increased only a few pounds. This represents a considerable advantage to designers of our military planes.

As ships increase in complexity, the need for automatic operation becomes more pressing—to free air-crew members for more important duties. The resources of General Electric are devoted to the manufacture of such automatic systems. Systems that automatically position coral flaps and interocular shutters, synchronize the operation of two or more parts of the ship, control emergency-take over flight operations formerly performed by the ship's crew. The flexibility, reliability, and light weight of electric control and operating systems are reasons why many designers now make it electric when they make it automatic. General Electric, Schenectady, New York.

Aircraft electric systems designed and manufactured by General Electric make possible the automatic control of many different flight operations. The degree of secrecy required is so great that we cannot publish information about these integrated systems now. We are glad, however, to discuss the application of automatic electric systems to aircraft with design and production engineers.

GENERAL ELECTRIC

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G-E voltage regulators, to maintain correct voltage, and relays to control generator current flow complete the electric generating system. Each of the three units is designed to function with the others as part of a co-ordinated system.



TYPE P-10 AIRCRAFT GENERATOR

 The design of the G-E aircraft generator is the result of the cooperation of the design and production engineers of the G-E plant and the aircraft manufacturer.



Star-Spangled RATIONING

In wartime we expect our fighters to have better guns for knocking off Nazis than we keep around here for knocking off squirrels.

In wartime we are glad to see our cars a lot less to the boys in Africa and Australia than use their tanks and planes a lot more.

In wartime we are proud to turn over our factories to build products that fight, instead of the things of peace.

In wartime we are happy to buy bonds that help carry something more than moral support around Marmoset way.

But how far personally are we really willing to go to help win the war?

There are men who hid hundreds of gallons of gasoline in their basements before rationing.

There are women who tucked their closets full of sugar before the lid went on.

There are people who wore themselves foot-sore buying up coffee before it was restricted.

These folks perhaps have no sons in the Solomon, or husbands, brothers or relatives in Africa.

They perhaps feel only the cold wind on their necks when they uncover for the Star-Spangled Banner.

They for sure are in the minority—there

just can't possibly be more than one American woman to every thousand American patriots. As makers for years of essential parts for automobiles and airplanes as well as products for home and farm, we believe the way Americans are wearing their "A" cards indicates the spirit with which they will meet all other forms of wartime sharing and rationing.

We believe the true American breadwinners and housewives and their thinking children—and there are 130 million of them—see the advantage of all Americans at home sharing alike—see the need of first providing adequate food and supplies for fighting forces and fighting allies.

★ ★ ★

We believe if there isn't as much food or gasoline or clothes to permit everyone to have as much as he wants, the supplies that are available should be divided as equally as possible so that all may have a fair share.

We believe rationing should be maintained only as long as these wartime needs are present.

We believe rationing in wartime is not regimentation

—it is merely applying the Golden Rule clear across the board in a good cause.

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on the road, in the sky, on the farm, in the home

Aviation People



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PAUL E. RICHTER, vice president, has been named chief of engine division of Borg-Warner Corp. in Chicago. He has been in the company since 1934.



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WHY waste time and material? Reclaim broken, cracked, worn or defective castings, easily, economically. Use Castolin Eutectic Alloy 214 (gas welding) and Castolin Eutectic Alloy 234H (A.C.E.C. electrode arc). These new low temperature welding alloys assure you of a completely non-shrinkable, color matching, stress and distortion free weld every time.

Practical manufacturers now use Castolin Eutectic Low Temperature Welding Alloy 214 & 234H in place of "hot dip" furnace welding, red, Castolin Eutectic Alloy 214 & 234H require no pre-heat, no post-heat, no stress relief.

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Castolin Eutectic, Low Temperature Welding Alloy 214 & 234H are the only low temperature welding alloys which are non-shrinkable, color matching, stress and distortion free. They are used in the aircraft industry for the repair of damaged parts.

Tool Salvaging Point for your Shop First. See Castolin Eutectic Low Temperature Welding Alloy 214 & 234H.

**EUTECTIC
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America At War (Continued from page 110)

age, that entered the long planes in the production series.

All who had expert information knew that the error would start up as soon as this materials problem was solved. Incidentally, none of the materials that went to speed airplane output were taken away from other equipment which in combat had proved to have less stringent values. Of course many factors other than an error free of metals are bounding airplane production. One of them is the additional production capacity created through construction of new plants plus expansion of existing facilities. This will continue.

But no wonder is one problem solved that a new one pops up. Requirements of war, like the demands of war, are insatiable. To the materials problem, which will persist in 1945, will be added a new one—shortage of manpower. Y. P. Wright, American Production Control director, says that in 1941, the aircraft industry's problem was getting tools, in 1942 it was getting materials and in 1943 it will be the combined problem of obtaining materials plus manpower. Airplane producers will have to rely and compete for men, for men, and for women this year, but eventually know they will get them, because aviation is recognized as a most vital weapon, even ahead of tanks.

Yes, the problems will be solved. Army, Navy, and WPA made a joint Six Year statement in which they do insist that about four for number and about four times the total weight of planes built in 1942 will be built in 1943, with emphasis centered on bombers designed to carry the maximum of destruction to enemy landing forces and enemy industrial centers. It is the statement: "Great importance in the airplane plan for this year is placed on survival, increased dropping and aerial escort and combat aircraft." There you have the big three—and note that airplanes come first.

As both Churchill and Roosevelt have said, the enemy's weapon is war. More specifically stated, that Japan's and Germany's resources are so depleted now that they cannot materially increase their airplane production. Our present rate, plus that of our allies, is probably enough to beat the enemy. But nobody is betting on that. It is now said in Washington that our 1943 goal is a set number of planes somewhat greater than 100,000. Mr. Wilson predicts that our rate will reach double the present production, going at 12,000 per month. To build 100,000 planes, it now readily (From page 109)

Learn About a NEW Source!

MOLDED PLASTIC PLYWOOD



This free book—just published—surveys the facilities of the West Branch Novelty Company (a Valid Licensee) for the manufacture of molded plastic plywood. Products, location, transportation, floor space, equipment and type of personnel are all described. **Write for this book today**—you need it to complete your file on molded plastic plywood!

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Then the pilots were climbing over eight miles straight toward the enemy ships, where over the highest Bay, bombers would go. They brought it screaming down out of the clouds like forked vengeance. They poured down the electric and a few hours later up higher even the Indians. They passed the target before and saw how mechanical fire power from its cannon and machine guns could up upon anything on water—and there was only one ship left at Lightning. So there is no more, a name is earned from British and American pilot alike, a name to watch Lockheed Lightning, Lockheed Aircraft Corporation. Page Aircraft Corporation. No back, Oklahoma.

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son. Most of the work had been closely associated with Gen. Billy Mitchell and had absorbed some of the valuable principles of Dale's Gun Doctor. The air doctrine these leaders hammered out, crystallizing various theories and ideas, was based on the needs and problems of America. Giving attention to use cases known and kept ahead of new weapons from potential enemies by elements of order, and with technical officers rather than defensive fighting spirit, they developed the long range bomber as the keystone of air power. The American problem, (as contrasted with that, say, of Britain or Germany) was long range efficient operations in day favorable weather conditions—which demanded sufficient altitude to fly above clouds (at least) fire, and on the other hand required efficient bombing precision, since a ship is a small target from 50,000 ft and up. As a part of this emphasis, the precision headlights were developed for daylight operations, and the larger bombers were to be handled by highly trained crews over visible (and/or specified) landmarks and aerial navigators. Long range operations over land objectives were not just in the same general considerations.

The second problem was the development of attack tactics, responsive work with ground forces consisting of mobile airplanes and techniques for fast, low-flying sweeps against specified targets, with heavy machine guns, and nose fire, and light bombs.

A third subject for study and consideration was fighter operations with special emphasis on interception of enemy planes and air defense.

In addition to the above there was a demand that air power be self-sustaining by means of a fully developed air transport service, with the slogan, "All air force supplies by air."

These dynamic ideas have resulted in high measure of freedom (1) in the establishment of a more widely organized service, at the Battle of Britain and Consolidated B-24 Liberator high altitude heavy bombers, and the B-29 and Norden bombsight and various navigational instruments; (2) the light or attack bomber, of which the speed, hard-hitting, versatile Douglas A-26 Havoc is the current example; (3) the specialized types of fighter planes for Army cooperation and for interception of enemy planes; and (4) the increasing expanded world wide service of the Air Transport Command.

Certain other general principles governing the content and operation of an air force were developed by these leaders, and they have been completely vindicated by recent events. These include the beliefs:

—(a) an air force may be in (Turn to page 489)

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being when war is declared, or at least here a framework of organization, for housing and for procurement of aircraft, which immediately can be expanded on a large scale.

—that air forces must be balanced components of at least three essential agencies—armies, air bases and air planes, and that for air these agencies a fourth is essential—air supply.

—that Air Forces are not merely auxiliary components of armies and navies, but that in addition to the admitted experience of close cooperation with ground and sea units, they may have separate and distinct missions—that they may materially affect the ability of the enemy to wage war by destroying his manufacturing establishments, ports, and communications.

—that airplanes are the weapon of longest range and greatest mobility. Thus, among the important projects worked out by the GEC AP are included the 20-ton B-17, the 30-ton B-24, and the 40-ton B-29. Our present heavy bombers, and the super-bombers just over the horizon, are a transition from these revolutionary plans.

—that military airplanes must be of varying and proper types, designed to carry out specific missions. There must be long range bombers capable of reaching any part of the enemy domain, but also medium bombers for destruction of objectives at shorter range, and light bombers to work in close cooperation with the ground forces. There must be fighter aircraft to intercept enemy bombers, destroy enemy fighters in air combat, and gain local air superiority for ground operations. There must also be reconnaissance aircraft for the gaining of military intelligence by observation and by photography, transport and cargo planes, and various types of trainers. These separate and distinct types must be provided in proper proportion to make a balanced air force.

—that the production rate of planes turned out at the Cordeliers was not the final criterion as to whether our air forces were being properly supplied with military aircraft. The only planes which counted, as a practical matter, are those which are completely equipped, with all instruments, communication, etc., and available for action.

—that for proper defense of this country, advance air bases must be built up in such strategic areas as the Caribbean, the Canal Zone, and the Hawaiian Islands, and that Alaska is of primary importance in the control of the Pacific. This last point was given dramatic emphasis in the light of Marine B-24 bombers in Alaska in 1933 under the leadership of Brig. Gen. "Doc" Amund.

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using all metal auto-engine bearings for long endurance operations which led to the development of the B-17, our primary offensive weapon in 1943-44.

Builder's Plans

We have noted some of the air craft instrumental in the development of the long range bomber, B-17, and the development of the B-17, our primary offensive weapon in 1943-44.

May Gen. Lewis H. Brantzen, commander of the North Air Force, Mobile Unit, under the very all command of Gen. Frank M. Andrews, who was transferred to this command at the time of the South Atlantic campaign.

May Gen. Ira C. Egan, chief of the Bomber Command, European Theater, Gen. George C. Kenner, air chief of the Bomber Command, Gen. Kenner was in charge of G-4, Operations, on the B-17, and is reported to be one of our outstanding aviators.

May Gen. Edgar Bradley, now in Europe, who headed G-2, Intelligence; May Gen. Joseph McNamara, General Marshall's Deputy Chief of Staff, who was in charge of G-4, Supplies and Property.

May Gen. Robert Olds who had charge of the development of combat crews to operate the B-17's as fast as they became available in 1942-43 (it is noted that surviving to make that a commendable record of the Second Air Force (Northland) is at present operating the vital line, officially named "operational transfer").

May Gen. Willis Hale, chief of the Seventh Air Force, Hawaiian Department, with Gen. Carl H. Hansen, Chief of Staff, Fifth Air Force, and May Gen. Harold L. George ("Bombardier George"), commanding general, Air Transport Command.

In most of the spectacular flights of the Flying Fortress, such as the powerful trips to South America, night operations to support programs of the air defense force in Puerto Rico, Guam, etc., the big ships were usually piloted by Hapson, Glan, or George (the names are identical). The group of about a dozen long range bombardment squadrons, plus a couple of fighter squadrons we had some later, are the ones piloted by the Army General Staff in the most intricate operations in the war to victory.

Another of these pioneers was Gen. Gen. Walter E. Anderson, commander of the 15th Bombardment Group, which was sent overseas during the first year of our war in the Pacific in almost unbroken order. (He is now director of Bombardment Air Staff, Washington.)

His group flew B-17's across the Pacific during the summer of 1941 as (from page 413)

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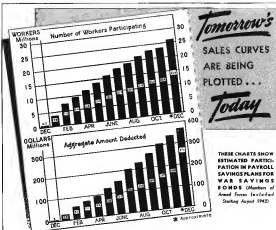
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Here indeed is a solid foundation for the peace-time business that will follow victory. At the same time, it is a real tribute to the voluntary American way of meeting emergency needs that has seen us through every crisis in our history.

But there is still more to be done. As our armed forces continue to press the attack in all corners of the globe, so war costs mount, so must the record of our savings keep pace.

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order to build up their strength in the Philippines. The unit of three left Manila Field on Dec. 6, arrived at Elkanah Field on the 7th, then flew on to Clark Field, P. I. Those who remained after the attack there (6th elements) having destroyed the aircraft warning system) operated for a time from Marikina, then flew to Zera, and later to Australia, our squadron operating as reconnaissance and then as bombardment. Heavy raids were carried out against Rabaul, Lae, Solomons, and other targets in the Solomon and New Guinea, participating in the battle of the Coral Sea, Midway Bay, and the Solomon sea battles.

These air attack groups include many of our Pacific heroes such as Glen Kelly, "Bobby" Whelan (75-man battle with 18 Zeros), Alvin Mueller (brought back B-17 with 1000 holes), etc. The group has been cited three times by the President, and more than 1,000 medals have been awarded to the dead and living of the 18th.

In their engagements, the 18th lost numerous out at Langley Field received their baptism of fire and were fully vindicated. As a testimony to the value of close team work in heavy bombing operations, Gen. Haskins stated that if a couple of bombards with highly trained crews were sent on a mission, and night or even poor weather was a steady show, the results would be about equal. Gen. Haskins, by the way, often accompanied his men on these raids, and on one occasion, after three narrow escapes from Japanese bullets, he remarked "I am beginning to believe these were not of Japanese don't take me." Another toast of American air doctrine—the general led their men, rather than sent them. Exemplary, too, are Reg. Gen. Ken Walker ("let me be back in 100") in New Guinea, Reg. Gen. Joe Baker in the daylight Pusan raids over Europe, Maj. Gen. "Lone" Stevens, Maj. Gen. Jimmy Doolittle, etc.

Partisans in the Pacific

The intrepid 18th Bombardment Group started off with B-17's and D's, and the speed and precision of them let B's get them through many a tough spot. But when they and others began getting the B-17's and D's, with two of these worked B-24's high velocity gun in the tail, the fun really began. Another point in American air strategy was provided the B-24's began. Another, on account of its long range, must be capable of self-defense, because of the impossibility of fighter planes going all the way with them for protection. The Partisans that B-24s came out of the clouds by the score.

Before leaving the Pacific theater, it might be well to point out something

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PRECISION DIE SETS

that is often overlooked in regard to high level bombing at sea. Depending on the size of the bomb, it takes from 20 to 30 sec. for a bomb to drop from 20,000 ft. If a single bomber is employed, it is entirely possible that a fast ship could maneuver sufficiently in that brief space of time to evade the bomb. However—and this has been particularly true since August, when independent measurements of the latest *Forerunner* models have been available in the south east Pacific—such bombing almost always is done in a close pattern by from 10 to 18 aircraft, and in these circumstances such evasive movement is possible.

On the other hand, the weather and other considerations frequently make such high altitude work impracticable, and during the past few months, more and more it has been found that both heavy bombers (Forerunners and Liberators) and medium bombers (B-25 Mitchells and B-26 Marauders) have been dropping bombs at 12,000 feet and even lower to get in their deadly work.

This seems at first a good step in any where to conduct U. S. Naval Aviation, generally considered to be tops in all the world. Very plain, working patrol bombers, scout, torpedo bombers, dive bombers, and fighters, are without rival anywhere, and very training and up-arming techniques are among the best.

Reversing Opinions

In the European theater, the Americans had to overcome the handicap of a well-entrenched opposition held by forces in both England and Germany and largely supported by their own prisoners in daylight bombing—that no multi-engine plane could hope to stem against the small, sharp-nosed, single-engine fighters, the so-called "Queens of the Air." It was feared that our heavy bombers, both Forerunners and Liberators models, would prove no match for the fast, maneuverable Bock-Weg, 109's and Me-109's and G's, or for the very heavy, but concentrated over strategy-tailored Ju-88's.

Two factors were considered. First the effectiveness of our bombers. From all angles, many of them from power-operated turret, as equipped with the heavier 90-caliber guns aimed by the British, American, the German, Japanese, and Japanese. Second, the fact that in operating by daylight they would have from great heights with a powerful daylight and therefore could not of the anti-aircraft fire which might hinder, even more because they were in lower in sight than at night.

The remarkable success of the daylight raids from the start of the campaign in August, with scores of the best American pilots and planes shot (There is page 517)



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We're the gremlins that make one engine do the work of two when a bit of extra work can't be done over the horizon.

We're the gremlins that stare off a stall when your student begins the place on his prop.

We're the gremlins that keep you in the air when the bad gremlin gets on your wings.

We're the gremlins that take you upstair to get a son of the ring can before he lays an egg on your tail-fin.

We're the gremlins that beat your ever motor in peaks that stay from their workings and suddenly run up before you on dark nights.

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night and day to
strike with in-
creasing fury



at the enemies of democracy * * * *



Yet no other form of transportation ever achieved as much progress in so few years as has aviation. It has explored and conquered a new world, it could reach more than all the ships and wagons it covers. Conquering the world is easier than conquering the air. The first step is to be found without first becoming one within the air. We had to decide how to build an airplane before we gave up where and around what we were going to fly. The single form of transportation is capable of, by itself, it is a question of what else the most efficient use of air can have upon all other forms of transportation—how aviation can change the transportation of goods and reduce the transportation of people to the insignificant level.

High-ranking British air officials have also stated their admiration for the strategic move to which our air power was being put in the difficult Pacific theatre, particularly in such well-planned raids as those by Gen. Reginald to the Philippines from Australia, and by Gen. Douglas to the Tokyo area.

The arrival of a flock of B-29s flew in the Middle East, and their efforts...

If this premise be sound, then an increase in the demand for transportation. That we are faced with the need to do fast things isn't. To determine how much we may capitalize the advantages of air. It is up to the American people whether we make an disproportionate the dominant force of transportation.

The correct approach to the postwar transportation problem, we believe, begins with a vigorous, forthright, and unilaterally based resumption of construction of the railroads of Thailand.

First, we must understand this—that it is, where it is, what prohibitions for bounties it offers if we waive it, and what damages it will be to other nations. Only then can we determine how best to profit from the great office.

Fiscal involvement of May states' actuals, to appear in next month's *Surveyors*, will cover elements of actual bonding, ground cooperation, inter-union, and transport, as developed by the 2 new State Acts.

Festive Transport

(Continued from page 118)

derstanding of, and experience with, those means of transport that are of necessity confined and limited to land or to water. In contrast, we have little more than about thirty years' experience. On the one hand, countless generations—on the other, less than half of our century.

Yet no other form of transportation ever existed on such grounds in so few years as has occurred. It has replaced and superseded a new world would reach larger than all of the lands and waters it covers. Consequently, I do not believe the answer to the question is to be found without first determining our status in the air. We had to decide how to utilize propellers before we gave up boats and swimmers. It is not a question of what single form of transportation is capable of, by itself. It is a question of what effect the most efficient use of air can have upon the vast areas of travel. We must determine how aviation can change the integrated function and value of all surface methods.

Surface methods are limited to two dimensions. Trucks can only go where roads go on land, submarines mostly go where there are paved highways, ships travel only where there is water. Because air is everywhere (an all too imaginary fact that we believe requires constant repetition) the airplane presents the greatest transportation potential in the history of mankind.

If this premise be sound, then an is now the dominant mode for transportation. That we are faced with the need to do first things first. To determine how much we may capitalize the advantages of air. It is up to the American people whether we make air transportation the dominant form of transportation.

The correct approach is the positive transportation problem we believe began with a vigorous, forthright, and intellectually honest rearranging of century-old habits of thinking.

First, we must understand this—that it is, where it is, what prohibitions for benefit it offers if we abuse it, and what deters its use by others means. Only then can we determine how best to profit from this great virtue.



For Victory...
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ment is found in the record of the slow acceptance of aviation by people everywhere. Today, it is also evident in every war bulletin and in the controversies such as, that about battleships versus airplanes. War, not peace demand, caused our great production expansion. If we do not wish to be undisciplined as, then our minds are out of focus on the postwar transportation problem in its entirety, and we are disqualified as competent planners for the future.

Scientists tell us that every individual has two brains. One, the *main* brain,



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when function is to store and protect the individual structure, the other the individual design. For thousands of thousands of years, ever since the first cavewoman was born, women have been storing things. 'Don't do it', if it was a hundred years, was, in different things. Gradually, over the centuries, the structure of the storage house, and the way of storing things, changed. The storage house has been moving, and the automobile has quickly and unerringly adapted the automobile is a storage vehicle. Now, in all of man's civilization of history, the storage house has been used upon to support anything so much as man's going of the earth's surface and traveling in a landless manner. Therefore the very kind of the earth's civilization, movement, or travel is the way of the landless man will live in future transportation equipment.

It is not only that air transportation will prove all need for surface vehicles. Walking is a method of surface transportation, and it will continue. There is no possible to grade the highways and for the cars to travel. There is no possible to build the paved roads for automobiles. But automobiles did not simply do what horses did; they did what horses

would do. And in so doing, automobiles created wealth that did not exist before. They created wealth of money to create other and higher levels and to enjoy benefits in many phases of their lives.

Could a twenty-stable model, man, thirty years ago, who refused to understand or within the automobile, be compared to play his community's future growth, prosperity, and welfare? Such a man would have opposed the building of highways and the paving of roads. His opinion was that he was getting the greatest capital in every nation, carriage, money, and human shape would, if followed, have done his home town to extinction and stagnation in a metropolitan where the lifeblood flows freely between all centers of population and activity.

In the language a ridiculous hypothesis to adopt when considering air power transportation problems? We think not, because we believe the increasing use of air will bring a new formation of cities, the earth, and greater than that which automobiles accomplished within continental United States. The use of air will do it in less time, with effort that will dwarf the changes brought by motor cars. We know that belief and again we know that belief (and again we know that belief) (see to page 421).

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SINCE the '90s, the highest tribute to the reputation of Zapon Division and Zapon-Kerazol Division has been the continued friendship of the thousands of customers whose good will we have earned through the years. Unrattling Zapon research, cooperation and understanding of customers' problems have characterized our relations. For the future, Zapon continues with all Atlas in development of finishes and coated fabrics for the aviation industry.

ZAPON INDUSTRIAL FINISHES

cover a wide range of uses and fully meet both Government and industrial specifications. Lacquers, enamels, synthetic enamels, novelty finishes—Zapon has developed coatings for every industrial requirement. The most exacting finishing problems have been a challenge. Today, we are busy with finishes for military aviation and other war needs. Yet even now we are in many new Zapon developments promising materials for post war uses.



ZAPON-KERATOL COATED FABRICS

have long enjoyed a reputation of the highest quality for strength and wall covering. Sturdy, long wearing, resistant to flexing and aging, they combine function with beauty. Their color, finishes, designs and grains have appealed to a long list of designers, decorators and upholsterers. Though these facilities are now turned to the production of coated war materials, our skill and our new developments in manufacturing coated fabric promise considerable new materials after the war. New uses for example any revolutionary present manufacturing process.



INDUSTRIAL FINISHES ZAPON DIVISION

ATLAS POWDER COMPANY
STAMFORD, CONN. • NO. CHICAGO, ILL.

COATED FABRICS ZAPON-KERATOL DIVISION

ATLAS POWDER COMPANY
STAMFORD • CONN.

relieved by the fact that it is everywhere. It is the same everywhere, and wherever there is air, airplanes are found. That makes the promise of planes and people in our own states as well as distant foreign lands.

Take it or not, we have physically made all human beings on earth into a group of their neighbors. It is not a question of what aircraft are capable of doing, either there we now have in the air or on the driving lands. We are so fast. We believe that, sooner or later, for more things that are now being transported by surface means, will also be transported by air. . . . quicker . . . and cheaper. A short time back we used very little about cargo planes, but today they are accepted and are an important factor in our transportation planning.

The only question, in my opinion, is what distances we intend to do for them. The real problem is in this problem is in the needs of man, not in our engineering genius, not in our aerodynamic experience, not in our production or operation experience.

I make an specific prediction for the expression of nations in the post-war period. I do not claim that we will be transporting coal and iron and wheat by air ships, but I am satisfied that in the very near future—the next year or two, of the jet-air transportation will be based around to meet the demands put upon it for rapidly increased transportation of passengers, mail, express, and cargo.

With thousands of thousands of our expert flyers relieved from war, with millions of other skilled personnel available, with tens of millions of our people definitely committed to our nation of the manufacturing and engineering capacity planning for a chance to meet the new challenges of the air, one would indeed be stupid to underestimate the future battle for business which I believe will be waged in the air.

the air. International competition in the battle course of the air will surely shape all previous international economic competition.

Records, a lifetime man who regularly travels by air said, "Consider this point as my hand in a post-war transport plane. We cannot think of it as luxury and faster than say, in service for domestic airlines in general. Now, what troubles me is this: When I think of how much such a single plane of its own can pay load capacity and high speed is capable of transporting, I wonder whether we shall not all of the capacity of our transportation airplanes before the war is over."

The reply he received said a hypothetical transportation man who could have said says, "I'm not sure I hold a lead pencil. Let me imagine that it is a business manager. When I consider how much one airplane is capable of doing, will we need a large commercial industry?"

The usual, obviously, is that the automobile did not properly replace the horse. It made possible new transportation and new transportation changes. It increased transportation largely beyond the stage of horse-drawn vehicles. So it is with the airplane. It does not "replace" surface methods, a supersedes them. It makes possible what is impossible for surface types. Therefore, much of the transportation requirements about airplanes are founded on a false premise of competition.

If you are asked, "What do you think the future is for railroads on land, or the ship on water?" answer with this question: "What do you think is the future of aviation in the near-future?" In relation to you mention, and what, aviation, you will have it. Once we do have it, in the first instance that constitutes good business, then all surface methods will automatically fit into their relative and valuable place, "functioning as an integral part of the system."

(Turn to page 422)

Stamping Grounds

SMALL TOUGH JOBS...

Typical work produced on 20-ton Stamp Press. From No. 10 to No. 6 sizes in lengths over 100" to 1/2" diameters or 1/2" to 1/4" thick up to 1/2" wide. Inverted and turned parts can be produced successfully. QUANT quantities in production of stamped drums and innermost parts including brass, 80% to 100% metal stamping using all type metals and alloys.

GOAT

METAL STAMPING, Inc.

Division of THE INCO GROUP CO., INC.
Manufacturing Facilities near 1401
215 MAIN STREET, BROOKLINE, N. Y.

A BETTER ANEMOMETER



Here's why

Do the bearings rotate freely? No

Any sliding contact? No

Batteries an external power supply? No

Write today for complete details of this precision instrument and its accompanying Wind Direction Indicator.

AIRDESIGN INC.

210 Parkside Ave.
UPPER MERY, PA.

fast, accurate DRILLING IN CLOSE QUARTERS

■ Many air equipment contractors already in quality service with this fast drilling attachment. Because it is so portable and so powerful, it is perfect for use in confined spaces. Controlled air pressure and high speed rotation make it possible to drill holes in any material in any position. Full details in report.

GEORGE A. TERRY CO.

210 South Broadway
Rochester, N. Y.

SHOULDRILLING TERRY ATTACHMENTS

TERRY

REG. U.S. PAT. OFF.

wisely operate" of American postwar transportation.

Let us not wait the end before the battle. It is imperative to try to remove the potential of material aid by the limitation of nation-owned free-ports. Especially so, as immediately free the need for the United States already to be demonstrated in the war where Allied shall of around the peace table with us. It is obvious that nothing is more necessary to our postwar transportation than the strengthening and developing of our facilities in the air-bus now and in the future. I firmly believe that the major factor in the peace will be the one goes into those countries with the strongest position in air transportation.

Financial Outlook

(Continued from page 156)

The provision was to apply to all air contracts and to all open contracts upon which had payment had not been made, and there were other clauses to get back into the provision, such as measures to withhold payments of profits were excessive, to bring action in appropriate courts, and to impose fines and prison sentences for willfully failing to furnish data or for supplying

false and misleading information.

At the instant, this section was allowing to the aircraft manufacturers. It was feared that this measure would increase time and expense that should more appropriately be devoted towards the production lines. But some of those in the industry considered Public Law 408 a providential agreement, since it was a means of avoiding the potential stigma of profiteering.

An Aviation has repeatedly indicated throughout the past year, many small companies are given relatively more they found their estimates of costs had been too high and on actual have been established for existing price schedules. For an industry that barely existed five years suddenly called upon to accomplish a "miracle of production," there were no previous profits as to what costs would amount to under volume output conditions. Thus new cost standards were established, relative were made voluntarily, before the passing of the law.

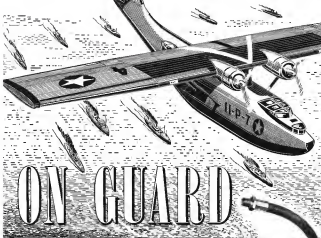
The military services have also been placed with the workings of the re-provision processes. While it is difficult to negotiate savings on aircraft contracts, an overall estimate is available for the entire war production program and it gives an indication of the relative returned by the aircraft builders.

Measure Karlsen, chairman of the War Department's Price Adjustment Board, has announced that as of Jan. 1, 1945, the savings through re-provisioning of contracts amounted to \$1,000,000,000. The War Department's Price Adjustment Board estimates that as Oct. 31 it had obtained or was negotiating reductions and price reductions of \$100,000,000 before taxes, while additional price reductions of about \$100,000,000 had been made voluntarily in anticipation of re-provisioning.

Adding these savings, with estimates for other voluntary and non-voluntary reductions of the other government agencies and the Army, it appears only to say that up to the present time the cost of the war has been reduced by at least \$1,200,000,000 before and after Public Law 408 was enacted.

Mr. Karlsen recalls that "the power of legislation have caused such a favor in business circles. The law was enacted in an instance of business-like spirit. It was deemed as the beginning of "solidity" and a new level of production of obligation returned as in good faith."

Hopefully, this did not work out in the expected manner. Instead of increasing profit profits in a steady state, the re-provisioning process is becoming recovered with forward pricing.



against Vibration, Varying Pressures and Extreme Temperature Changes

WEATHERHEAD FLEXIBLE HOSE

BUILT to meet the toughest service demands, Weatherhead High, Medium, and Low Pressure Flexible Hydraulic Hose assemblies keep hydraulic hoses flowing to vital mechanisms on every type of military and commercial plane.

Withstanding heat, cold, vibration, strain, and varying pulsations of pressure, Weatherhead assemblies are used for fuel lines, oil lines, instrument lines,

and hydraulic applications of all kinds.

Prime contracts with the Army, Navy, Marines, and Coast Guard are evidence of the reliability of Weatherhead.

Other Weatherhead airplane accessories include Dual Tube and Pipe Fittings, Vacuum Selector and Check Valves, Hydraulic Check Valves, and Hydraulic Actuating Cylinders. All are manufactured to Air Corps, Navy, or "AN" specifications.

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Every war front begins at home

The Pioneer Parachute today being mechanically inspected upon strict and which will be right put upon a whole in actual use and receive great thanks. This is a first step in a series of production processes which is reflected in the repeated success of Allied paratroopers.

THE Army-Navy "E" Award which has been conferred upon the Pioneer Parachute Company is a tribute to the patriotic spirit of our employees and the cooperation of our subcontractors and suppliers, whose efforts have enabled us to achieve new production records. And we acknowledge also, with sincere thanks, the patience of our loyal customers who have uncompromisingly deferred their civilian needs to the interest of the war effort.

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AVIATION'S NEW RIGHT HAND... at work!



Denison Diesel Test Stand for determining heat processes of devices in hydraulic systems.



Denison electric motor driven HydroOlie Test Stand for testing aircraft hydraulic systems using up to 1500 pound pressure. A similar unit, for 3,000 pound pressure, is also available. Self-contained reservoir, accumulator, and valve control provide for testing and adjusting individual parts of the system. Two all sizes, with individual selector valves, are provided.



Portable Spark Plug Test Stand for field use, providing a manual mechanical means of selecting spark plugs to high pressures so that electrical performance can be checked by an auxiliary unit.

HydroOlie Spark Plug Test Stand, for testing aircraft spark plugs in conjunction with an auxiliary aviation ignition tester. Plugs are subjected to selected pressure and high voltage. Automatic control causes voltage passing through the plug only when predetermined pressure is reached, and while readings are made.



In plants all over the country, Denison products are helping turn out war materiel. HydroOlie Presses are assembling critical parts... HydroOlie Valves and Controls are operating important equipment... HydroOlie test units are assuring safe, efficient operation of aircraft.

From these illustrations you'll see why HydroOlies has become the Aviation Industry's New Right Hand. The work of Denison engineers has opened a new range of applications for oil hydraulics, made it a better, faster, and more economical way of solving new problems and improving old methods.



Denison Aircraft Fuel Transfer Valve, used for manual selection of fuel flow from fuel tanks.



Hydraulic Propeller Test Stand, for testing distribution valves and feathering action of HydroOlie Propellers. Valves are checked by a special collar and pressure indication. With these installed, tests can be made for feathering action, blade angle, and seal leaks under high pressures.

Denison HydroOlie Packing Test unit, for testing aircraft hydraulic packings. Static pressure tests, and life tests at selected pressures, can be conducted with this unit. The companion unit, at left, provides for packing tests under controlled temperature conditions ranging from sub-zero to 165° F.



The DENISON
ENGINEERING COMPANY
1164 DUBLIN ROAD
COLUMBUS OHIO



DENISON
EQUIPMENT *as APPLIED*
HydroOlies

Magneto Test Stand, for testing airplane magnetos at speeds from 30 to 6500 r.p.m. Tests can be made at room temperature or, under the dome, at various conditions of heat, humidity, and altitude. Cooling in speeds, rotation, sparking, flutter, voltage-constant, and shunting resistance can be tested. Operating temperature of the stand can be controlled for making life tests. A similar portable magneto test stand, without altitude equipment, is available for maintenance service.



Pattern for VICTORY..



The Vertical Lathe. Lathe cuts production time to nearly 50% less in the factory of a famous maker of airplanes.

View of a Type "B-29" Multi-Ax. Mtns. machining station. Each of the 2 working stations has independent speeds and feeds.

Opposed to - View - Photograph

TEAMWORK . . . that's the passion of aviation in America today. The Army and the Navy are working together as never before. The makers of aircraft are sharing their engineering knowledge . . . with each other, and with their subcontractors. The split-second teamwork that flies with every formation of our battle-planes now has its counterpart on the production lines that send those planes aloft. When the victory is won, the credit will belong in equal degree to scores of organizations all over the land. Which is why the victory will be won.



The Bullard Company is proud to have a part in this united effort of America's aviation. Our Vertical Tower Lathes and Multi-Ax-Mtns are making precision parts for nearly every plane that flies. So great is the saving of time on each part the Bullard machines handle, that we are working 24 hours a day in the hope of soon approaching the demand.

We too have learned in this past year many things about even speedier production. Our engineering staff is eager to share this knowledge with you. Call on them freely.

THE BULLARD COMPANY

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GET ALL THESE ADVANTAGES FOR THOSE

Vital ENGINE TEST CONTROLS....

CASH STANDARD
Remote
**HYDRAULIC
CONTROL**
FOR ENGINE
TEST CELLS

Transmits oscillating motion . . . without mechanical linkage

* The mechanical advantages built into this type 550 Remote Hydraulic Control give aircraft manufacturers and aeronautical laboratories testing accuracy. This improved design in Remote Hydraulic Control is now demonstrating its dependability and greater value in actual service for numerous uses as engine test cells for controlling throttle position and mixture. The engine is remotely controlled from the test boards without mechanical linkage.

Type 550 has positive hydraulic power in both directions . . . no springs . . . no cups . . . no pistons. It transmits the total force applied to the control lever. Pneumatic brake locks it firmly in any position.



In remote design, better in actual tests with engine. This releases the automatic brake when the control is in any desired position. A valve holds and controls in remote calls when it is in any position where it will remain indefinitely.

Write for Data

We will gladly send you greater details on the construction and performance of this outstanding development in Remote Hydraulic Control for engine test cells. No obligation.

Positive hydraulic power in BOTH directions . . . no springs to provide moment arm way.

Transmits the total force you apply to the control lever (no cups or pistons).

No lost motion in either direction. Pneumatic brake automatically locks Control in any desired position, where it stays locked.

No vent line. The hydraulic circuit is filled by opening the control lever from one extreme to the other.

The relief connection for the brake is ported to the top of the reservoir in the seating unit. This holds hydraulic pressure in the system equal to the air pressure and prevents air from being drawn into the hydraulic circuit by the vacuum produced by any unbalanced load.

There are two hydraulic lines connecting Sender and Receiver, also one pressure line for the air brake.

Sealing unit is made for table mounting.

Receiver can be installed above or below Sender.

Lower of Receiver can move 90 degrees.

Receiver lever can be locked in any desired position.

Mounting bracket on Receiver can be adjusted to four positions for convenience in installing.

No mechanical fittings.



But can they TAKE It at 40 below?

In the far-flung war, instruments—like men—must be prepared to give their best in the face of all kinds of climates. The delicate parts that you manufacture for a field radio . . . may be called on to meet the biting winds of a Siberian winter, or the hot, blistering winds of the Libyan desert.

The "Transcendental Blue Altitude Chamber" is constructed for the rigid testing of instruments that have to undergo just such extremes of heat, cold, moisture and dryness. These units meet the test requirements of all U. S. Government Agencies: Army Signal Corps, Navy

Bureau of Aeronautics, National Advisory Committee for Aeronautics.

Range of temperatures as standard requirement is from -10° to 130° Fahrenheit — which can be extended to meet special requirements. Observation ports, insulated by multiple glass plate sections, are sealed to prevent interior condensation. Humidity is automatically adjusted to meet requirements of pressure, temperature and humidity. In the standard unit the pressure is controlled from atmosphere to 20,000 feet of altitude.



For complete details describe Transcendental Blue Altitude Chamber. Circular and Transcendental Blue Altitude Chamber and 400-Transcendental Blue Altitude Chamber. Write for more information. For more information write to: TENNEY ENGINEERING COMPANY, Inc.

TENNEY ENGINEERING COMPANY, Inc.
8 ELM STREET
MONTCLAIR, N. J.

A. W. CASH COMPANY
DECATUR, ILLINOIS

CASH STANDARD
CONTROLS..
VALVES



Four Good Reasons for Standardizing on These Micro Switch Actuator Brackets

Designed to Carry the Air Corps Approved Type E-31 Micro Switch...
For Complete Details of This Switch, Refer to Our Aircraft Catalog No. 70

These actuator brackets duplicate an aviation permit as they are considered a part of the switch.

They are all specifically designed to accommodate the Type E-31 Aircraft Micro Switch.

They are greatly faster and easier to install on the Type E-31 Aircraft Micro Switch.

They make field replacement of Type E-31 Aircraft Micro Switch very without disturbing bracket.



This new Type M-2 short-arm bracket saves weight. It is complete with control plunger and is interchangeable with Army brackets.

A-1 and A-2. Weights only 1.25 lbs., 42 lbs. less than Army brackets A-1 or A-2. The plunger on this bracket has a detent-controlled permit and control—a real "let go". The Type E-31 Aircraft Micro Switch is readily supported on this detent-controlled bracket by flush headed screws with lockwashers. The mounting holes in the top of the bracket are on standard 1/8" centers and square No. 6-32 holes.



The Type M-2 series of panel mounting brackets offer three lengths of threaded stems for easy panel mounting by hex nuts and lockwashers. Switch operation takes place in the first 1/2" of plunger travel. One-armed 1/2"



bracket is a sturdy mount and actuator for Type E-31 Aircraft Micro Switch. Two threaded stems replace stems used.



The Type H series of short-arm brackets, one of which is illustrated here, are complete with a plunger stem which can be angled against splash, dirt and oil. It is fitted with "A-S" wiper fingers, either straight or adjustable, 45 degrees. The plunger over-travel beyond the point of switch operation is 1/2" on the Type H and 3/4" on the Type H-2. The Type H-2, Micro Switch is easily installed on two mounting plugs within the housing.



The Type Y series bracket has an integral as a detent mounted switch, singly or in gangs. They are operated by cam on the detent quadrant or dogs in the tables. Any switch held detent can be instantly opened by the manual release without detaching either in the gang. Assembled one-arm switch the Type Y-bracket is without the need of a screw. Giving Me 70 handles general state as suitable for strength 445 for as many copies as you need.



Micro Switch is a trade name including manufacturers by Micro Switch Corporation

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Oil Resistance— ONE OF THE GREAT ADVANTAGES OF SYNTHETIC RUBBER

ASK the tanker crewman who has drifted for days on the sea in a life rubber boat... sloppy with the oil that runs rubber. They can testify to the practical value of the oil-resistant synthetic rubber that coats the fabric of such boats.

Ask the fighter pilot to whom synthetic rubber means fuel tanks that don't leak, oil lines and hydraulic systems. He understands the importance of oil-resistant synthetic rubber for his life depends upon it.

Of all the special qualities, such as resistance to heat, abrasion, compression and sub-zero cold, that 16 years of development work enable us to give Hycar synthetic rubbers, resistance to the deadly deteriorating effects of petroleum products is one of the most valuable.

When the vast requirements of war have been met, manufacturers in every industry will have available a truly All-American rubber, versatile, for more useful and longer-lived than rubber ever was a rubber that's laboratory controlled and value-made to meet a thousand different individual needs. Hycar Chemical Co., Akron, Ohio.

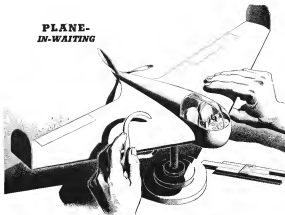
Available Now for Experimental Work



Although the entire extent of Hycar is devoted to the War Production Program, experimental machines are available to sell up to 100 pounds of Hycar per month in customer design experimental work. Hycar maintains a fully stocked and equipped Customer Service Laboratory to help meet requests of rubber product design and development of Hycar synthetic rubbers.



PLANE- IN-WAITING



Delco-Remy Aircraft Electrical Equipment

Today, it is in the back of some designer's mind as he works on problems of bomb-load, fire-power and combat maneuverability. In the days that follow Victory, it will take shape as a light plane produced in quantity to meet the civilian needs of men now serving in the air forces. ¶ The convenience and dependability of Delco-Remy starting, lighting and ignition will be a feature of tomorrow's private planes, while larger Delco-Remy electrical units, now built to meet the requirements of medium and heavy bombers, will serve on commercial planes. More than half of Delco-Remy's facilities are engaged in the manufacture of precision aircraft parts, electrical units and other products for the aviation industry.

DELCO-REMY

DIVISION, GENERAL MOTORS CORPORATION

IN PRODUCTION AS IN BATTLE *It's the Result that counts!*

**YOU DEMANDED IT
WE MET YOUR DEMANDS**

YOU wanted an 18" Duro Drill Press, Easy and Simple of Operation.

YOU wanted Ruggedness to stand constant service, also $\frac{3}{4}$ " drilling capacity.

YOU wanted weight flexibility and smoothness of power to give vibrationless performance.

WE have met all your wishes in this new massive 18" Duro Drill Press and we know the results will satisfy your most exacting demands.

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DURO FOR DURABILITY



A BETTERMENT . . .

Not a Substitute

The 1943 Scouting Plane is more than a substitute for the Observation Balloon of 1933.

The Scouting Plane is an advancement . . . a BETTERMENT!

And likewise . . . CONTINENTAL-DIAMOND NON-metallics are not substitute materials for concrete, weighty, costly, and now hard-to-get materials. CO NON-metallics possess unique characteristic con-

ditions that make them ideally suited to most many of the material problems of a war or peace economy.

Manufacturers who design to use CO NON-metallics to the fullest measure of their capabilities will never go back to "Glass-on-Rollover Doors" . . . because they will have built into their products NON-metallic materials which are as modern as today's Scouting Plane.

A booklet describes all FIVE CO NON-metallics. Ask for GF-12. True, when you are ready to get down to brass tacks, write, wire or phone us about your problem . . . or ask us to send around one of our Research Engineers.

Continental-Diamond FIBRE COMPANY

Established 1893 . . . Manufacturers of Laminated Plastics since 1911 — NEWARK • DELAWARE

FLOW RATE HERE IS THE METER FOR GASOLINE AND OILS WHICH FULFILLS YOUR ACCURACY REQUIREMENTS

The Stabl-Vis Rotameter automatically compensates for variations in Viscosity and Density!



Calibration Test Panel of Figure 112 Stabl-Vis Test Rotameters built for U. S. Navy.



Illustration of Figure 112 Test Rotameters upon test stand at Chicago & Southern Airlines aviation test.

As new types of test accuracy for rate-of-flow meters were made available to the Aviation Industry with the development of the Stabl-Vis rotameter. Thus, viscosity, changes in viscosity and density in the fluid being measured would result in errors in flow rate measurement amounting to as much as 30%.

By accurate research utilizing the hydrodynamic principles involved, the patented Stabl-Vis float was designed with an unbalanced shape which creates a dead space in the fluid flow around the rotameter float. By this action, the liquid flow is made to draw upon liquid instead of on the float body, and viscosity drag upon the float is prevented. As a result, the calibration of the Stabl-Vis rotameter is stable against viscosity variations.

In addition, by combining metal and plastic in the Stabl-Vis "Piston" float, the specific gravity of the float is made such that the meter automatically compensates for density changes when the flow rate measurements are taken in words units.

The Aviation Industry has wholeheartedly accepted the Stabl-Vis rotameter for flow into and out of the airplane. It is the standard flow rate meter in engine tests, for measuring hydraulic oils at low and high pressures in all of hydraulic systems and hydraulic accessories, for exact rate of flow at all temperatures, and for checking a wide variety of airplane equipment such as gyro pilots, de-ice pumps, gasoline heaters, oxygen regulators, etc.

For installation on the airplane, it is made in direct in-situ and remote-reading types for engine test flow. It is also used for hydraulic oil flow signals, and for propeller and carburetor check meters.

In all these applications its immunity to viscosity and density variations has given aviation the single for higher accuracy and much greater security in the equipment whose performance it is used to check.

The story of the Stabl-Vis rotameter is told in our booklet *Stabl-Vis*. Its application to the aviation industry is described in our booklet *Stabl-Vis*. Write today for these highly informative booklets.



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These needs of manufacturers using the Ozalid Process point to "everyday" savings in time, labor, and materials—savings which immediately appreciated when you're working against an ever-accelerating pace.



TIME An Ozalid works as fast as the speed of engineering drawings, charts, maps, or any such copy—Exposure and Dry Development. There's no washing, drying, fixing, . . . no cumbersome equipment with a hundred "variables" or possibilities. Ozalid transparent prints may be used in place of valuable original drawings—produced the same way. No "blue prints" or an elaborate setup, in change cabinets, as required for the work.



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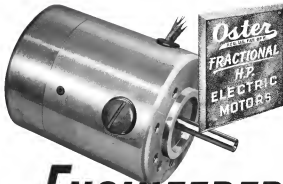
MATERIALS Can clear as well as red stock can be accommodated in an Ozalid whiteprint machine. Thus by using sheets which correspond in size to your originals, you can completely eliminate drawing waste. Further conservation is possible because no paper is lost putting up "leaders." So are any Ozalid whiteprints suitable due to durability.

WAYS FOR SUPPLIER PRINTING Our illustrated booklet explains the Ozalid Process and contains samples of Ozalid whiteprints with black, blue, green, and sepia lines on white background.

Ozalid Products Division

GENERAL ANILINE & FILM CORPORATION

Johnson City, N. Y.



1/4 H.P. AND SMALLER



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of Illinois
GENOA ILLINOIS

ENGINEERED for Dependability

Present war production of Oster motors is based on the same sound, thorough engineering which for fifteen years has built the reputation of Oster motor-driven appliances . . . The manufacturer who stands by the performance of his motors on his own equipment is taught in a rigorous school. He knows how to design a motor to fit the job. He has a vital interest in holding production quality up to the standards set by his engineering department. When you do business with Oster, you know you are dealing with a seasoned, dependable source.

361

PITTSBURGH'S SEVEN PAINT PLANTS

*Are Ideally Situated to Serve
America's Aviation Industry*



Pittsburgh's Important Contributions To The Aviation Industry

With its seven factories, Pittsburgh is ready whenever and wherever America's airplane construction program calls for paint protection.

Pittsburgh's wartime finishers do more than merely follow specifications and pass Government inspections. In Pittsburgh finishers there is an margin of superiority—a plus over specifications. It may

be extra suggestion which keeps an airplane in service longer—super-smoothness which cuts down wind resistance, saves horsepower and helps an American pilot easily and outright his opponent.

Whenever you have a question on paint, it pays to consult Pittsburgh—one of America's largest centers of aviation finishers.

When planes surgically bound in or near the large centers of airplane construction, Pittsburgh is in a position to give quick deliveries on rush orders. Transportation delays are eliminated. Since Pittsburgh is one of America's largest centers of aviation finishers, the paints and finishes available at these seven factories include all types—to take care of any requirement you may have.

When a special finishing problem arises in your factory, Pittsburgh technical men are only a few hours away. They will come to your plant and place their own experience, and the facilities of the great Pittsburgh laboratories, at your service. They will work with your staff until the right finish is found.

PITTSBURGH
Industrial FINISHES
SEVEN PLANTS IN PITTSBURGH, PENN. AND SEVEN IN OTHER CITIES

PITTSBURGH PLATE GLASS COMPANY
Industrial Plate Division, Pittsburgh, Pa.

Branches: Milwaukee, Wis.; Newark, N. J.; Houston, Tex.; Los Angeles, Calif.; Portland, Ore.

Other Cities: Detroit, Detroit, Mich.; The Thermo-Yanish Company, Dayton, Ohio



**We'll Be in Constant Communication
With Him Even Through His
THROAT MICROPHONE**

Common courtesy that a pilot's message will get through to his base clearly and correctly is provided by throat microphones—a pair of any, compact "mikes" that fit snugly against the throat. Words are picked up directly from the vocal cords, unimpeded by engine noise or gun fire. The voice alone goes through! And the pilot's hands are kept free for the immediate job of flying, lighting and flying.

For Everything in Communications—from Complete Systems to Single Parts—

Look to KELLOGG

Throat microphones are just one of the many products made by the Kellogg Switchboard & Supply Company for use by our Fighting Forces. Among the complete telephone systems, telegraph sets and radio components which Kellogg is making are telephones and radio equipment; field telephones and telegraph sets; hand, palm, and throat microphones; jack and control boxes; jacks and plugs; telephone cords, multi-circuit plugs and sockets; capacitors; and many other related and allied products.

Into these products go the same specialized engineering skills, the same precision methods of manufacture, that have made Kellogg an honored name in the whole field of communications for almost half a century.

Turn this experience to your own advantage by making Kellogg a source for every type of depend-

able communications equipment. The modern Kellogg plant, with its great production facilities, has the capacity, resources and manpower to handle all your current orders. Discuss your requirements with the Kellogg Industrial Sales Department. Write, wire or phone.

KELLOGG SWITCHBOARD & SUPPLY CO.
4400 So. Clark Avenue, Chicago, Illinois

KELLOGG
Finest Communication Equipment
FOR ALL PLACES

What's New in Plywoods?

OUTSTANDING DEVELOPMENTS IN
PLASTIC PLYWOODS FOR PLANES

plus

"A SERVICE OF SUPPLY" BASED ON
25 YEARS' PROGRESSIVE EXPERIENCE

are now at your disposal from

TECHNICAL *Ply-Woods*

WITH the restrictions on sheet metals, plywoods probably have solved more problems in plane construction than any other industrial development. But that's not the whole story. The new specialized types developed and introduced by Technical Ply-Woods have established unqualified superiority for many purposes. Each of those listed at the right has solved specific problems with complete success.

The history of their development is one of painstaking research over a quarter of a century by men thoroughly schooled in every phase of aircraft construction. They are manufactured from the finest materials, with new modern equipment, under skilled supervision.

We guarantee prompt shipment, in flat shoes, or completely fabricated parts (prefinished if desired). We will gladly furnish full particulars on any or all types, and answer any questions regarding your plywood problems.

TECHNICAL *Ply-Woods*

238 NORTH LA SALLE STREET • CHICAGO, ILLINOIS
LARRY E. HETTERICH, Director • A. A. CARLSON, Secretary

NOW AVAILABLE:

8 DISTINCT TYPES OF PLYWOOD

1. **PLY-TECH** Our standard, extra glass, hot shoe process plywood, available in all woods. Endorses in the aviation, government specifications.
2. **FRAB-TECH** Consists of a veneer core with fiber reinforcement to both faces. Combines extreme lightness with great strength, unusual stability and ease of working.
3. **WOOD-TECH** Consists of two faces of 3 ply veneer bonded together, glued to bamboo core construction. Outstanding strength and lightness make it perfect for airplane floors, partitions and seats.
4. **BIRL-TECH** Made from thin veneers subjected to higher pressure than those used in Ply-Tech—resulting in greater strength properties. Used for use in spars, mechanical plates, plywood chips, panel plates and dials.
5. **FRAB-TECH** Consists of veneers used as in Ply-Tech, but impregnated with a plastic resin before assembly, which gives greater dimensional stability. Especially for airplane propellers. Also desirable for various sheet surfaces and electrical housings.
6. **ARAB-TECH** An adhesive core with veneer faces. A Broyed panel, used for partitions.
7. **TEMPER-TECH** A resin bonded plywood, with either one or both faces is tempered. Proof-wood.
8. **MITL-TECH** Metal covered plywood, with either one or both faces as metal.

Aircraft SLEEVE TYPE *Bearings* ANY SIZE ANY TYPE ANY QUANTITY

Manufacturers of planes and aviation equipment have found Johnson Bronze to be an understanding and capable source of supply for their sleeve type bearings. Regardless of the kind they need—cast bronze, powdered bronze, cast steel metal, steel and bronze, steel and babbit or bronze and babbit—we can supply them to exact specifications.

Our more than thirty-five years exclusive bearing experience enables us to help decide which type of bearing is best suited for each application. Why not call in a Johnson engineer when you need bearings? He will help you without obligation. Johnson Bronze Company, 620 South Mill St., New Castle, Pa.

*Sleeve
Bearing
Headquarters*

JOHNSON BRONZE

**ACTUALLY RIVETS
10 TIMES
FASTER
THAN HAND-FED MACHINES**

**Chicago Rivet
AUTOMATIC RIVET SETTERS**

- Speed up Production
- Save Time—Money
- Cut Unit Cost
- Save Space—Power
- Conserve Man Power
- Save on Investment

Contrast the operation of a hand fed riveter with an automatic riveter and the savings in man power, time and money are too large to be ignored. Hand fed machines require the insertion of the rivets into the assembly manually and the locating of the assembly in the correct riveting position. Then, the machine performs only the clinching operation.

A Chicago Rivet Automatic feeds the rivets from a hopper into position for riveting. The operator places the assembly on a disappearing pilot and steps on the foot pedal. The machine inserts the rivet and makes the clinch. Up to 2000 rivets an hour can be applied, depending on the assembly.



MODEL 140 AUTOMATIC

Inserts rivets up to 3/16" diameter. Thread length 1/2" Stroke 7" to 2" in 11 models. 150" long. Rivet sizes, gauge heavy automatic. Automatic feed. Rivet. Clinching head. 100 to 2000 R.P.M.

QUICK CHANGE ROPPERS

(shown)

Automatic feed riveters, complete with new way assembly, for 100, 1500 up to 3,000 in diameter. Also, can be changed on your Chicago Rivet Automatic in a few minutes.



MODEL 71 BENCH TYPE
This bench type can be used for riveting of rivets up to 3/16" diameter. Rivet sizes, gauge heavy. 100 to 2000 R.P.M.

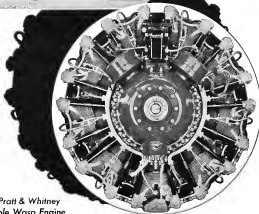
HAVE YOU CONSIDERED TUBULAR RIVETS?

While Chicago Rivet Automatic Setters will handle solid rivets, there are many other advantages in using when tubular rivets are used. Because a lighter, more compact rivet may be used, automatic riveting can be applied to many assemblies now hand riveted by reason of greater accessibility. Tubular rivets are lighter in weight and are set faster, and their use considerably saves on Army and Navy expenditures.

Complete Line of Automatic Rivet Setters for Aircraft

Chicago Rivet Automatic Setters are available in various models, both bench and floor types with throat depths of 6, 8, 9, 13, 24 and 48 inches. Production rates up to 2000 rivets per hour. The clinch of tubular rivets by Chicago Rivet. Many new and old requirements of Army and Navy specifications. Our riveting production experts will be glad to make recommendations for your particular needs. Send blue print or sample assembly when required.

SHIELDING for fighters...



The Pratt & Whitney
Double Wasp Engine
Illustrated Above is Equipped With

BOLTON SHIELDED IGNITION HARNESS

This 2000 H. P. Double Wasp Engine Is Standard for the
WORLD'S FASTEST FIGHTERS & BOMBERS

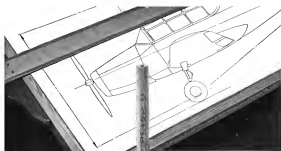
In our all-out effort, we pride ourselves on being able to serve the
Army Air Force **The United States Navy**
Leading Aircraft Engine Manufacturers

THE BOLTON MANUFACTURING COMPANY

692 Campbell Avenue, WEST HAVEN, CONN.

Chicago Rivet

CHICAGO RIVET & MACHINE CO.
9627 West Jackson Blvd., Chicago, Ill.



The Mighty Pencil

The man behind the ELDORADO is a threat to the Axis. His lead is proving as deadly as the kind used by the man behind the gun. His job is that of creating the blueprints of destruction to destroy said Axis.

Never underestimate the value of TYPHONITE ELDORADO pencils in Amer-

SIDE VIEW OF THE FAMOUS "CORNELL" PRINTER
This is a typical of the drawings printed out today with TYPHONITE ELDORADO pencils. We'll gladly send a blueprint of this machine, just drawing in mind it represents an enemy blueprint.

ica's drafting rooms. They're doing magnificent work! Drawings made with TYPHONITE ELDORADO leads insure clean, easy-to-read blueprints... in less time. There's no time out for making in... the density and accuracy of ELDORADO'S leads guarantee blueprinted whites sharp—readable.

TYPHONITE ELDORADO

PENCIL SALES DEPARTMENT 61-52, JOSEPH DIXON CRUCIBLE COMPANY, JERSEY CITY, N. J.

LYON-Raymond

Specialized
Material Handling Equipment



Designed for the AVIATION INDUSTRY

TYPICAL DESIGN ARE:

1. Hydraulic hoist for changing motors in landing planes.
2. Cargo Handling Trolley with hydraulic leveling platform—for loading and unloading cargo planes.
3. Assembly Line Portable Hydraulic Hoist—for positioning planes on assembly lines.
4. Hydraulic Spinning Dolly—for rapid maneuvering of planes in limited space in hangars, factory floors or on Aircraft Carrier Decks.
5. Propeller Dolly—for transporting and storing propellers.
6. Portable Hydraulic Hoist—for positioning Superchargers in assembly line.
7. Portable Propeller Blade Rack—for transporting and storing propeller blades.
8. Hydraulic Steaming Work Stand—places workers at proper height for their jobs.
9. Hydraulic Leveling Hoist—for elevating crating planes.
10. Cattle Type Trolley—for transporting damaged planes.

The above are only a few of the specialized material handling equipment devices that LYON-Raymond has especially designed for the Aviation Industry.

We may have something to meet your particular problem. We would welcome the opportunity to study your problems and submit designs of equipment to meet them.

LYON-Raymond Corporation

214 Madison St., Groves, N. Y.

Material Handling Equipment for General Manufacturing
Hydraulic lift trucks Hydraulic pallet trucks
Hydraulic elevating tables Hydraulic car-handling trucks
Hydraulic short-handling trucks
Hydraulic steaming, leveling, and burning equipment
Special purpose production machines, hydraulic-powered



CECO

does its part

The same loyalty and patriotism which spurs CECO workers to "Keep 'em Flying" with production ahead of quota is also helping to "Keep 'em Buying" . . . ahead of quota.

CHANDLER-EVANS CORPORATION

MANUFACTURERS OF AIRCRAFT CARBURIZERS, FUEL PUMPS AND ACCESSORIES

What YOU Can Do About Scrap



EXECUTIVE:

Appoint a scrap director, armed with authority to set: Priorities for the use of gates, pay-scraps, cutters, and collection goals to enlist employees in the scrap campaign.

Make each foreman responsible for preventing waste in his department.

Before monthly checks in every department to find scrap material previously overlooked.

Report regularly on your plant's collection of scrap to the Industrial Salvage Committee set up by WPA in your community.



**SUPERINTENDENT,
FOREMAN, OR
TECHNICIAN:**

Survey all plant equipment, particularly idle, broken, or obsolete machines, and determine what might be salvaged, and what should be scrapped. Remember, any machine is more valuable repaired than scrapped.

Classify all scrap metal by its alloy content.

Provide separate containers, clearly marked for each class of scrap material.

Speed the return of scrap to steel mills through existing channels.



WORKMAN:

Check plant and yards for dormant scrap once monthly and abandoned equipment.

Report promptly the equipment which is out of use. If equipment has not been used for some time, and you see no use for it in the near future, transfer it to where it can be used, or scrap it.

Salvage usable parts from equipment marked for scrapping.

SCRAPPY SAYS:

You sly, we've got to have scrap. It takes scrap to make steel! And it takes lots of steel to win a war. Do Your Part!

ELECTRO METALLURGICAL COMPANY

Unit of Union Carbide and Carbon Corporation
30 East 42nd Street, 31ER New York, N. Y.



Electromet
Ferro-Alloys & Metals





Doing the same fundamental Job in 1943 but so much more of it!

Most manufacturers assigned to war production are working on products foreign to their normal efforts. But it's a different story here at WESTON. We have exactly the same job to do because our job is so fundamental; but there's much more, so much more of it. For precise measurement is vital to the efficient functioning of equipment in all branches of a highly mechanized war machine. And while measurement fundamentals have not changed, the universal preference for instruments the way WESTON builds them has not changed either.

So WESTON's job, as we enter the New Year, still remains the job of striving to keep abreast of the country's unprecedented and critical instrument needs. Production has been increased many fold through expanded

and modernized manufacturing facilities. And the curve continues upward. But never in the past where we must recognize, one bit, our quality standards — like some pilot's safety might be less secure ... a ship's navigation less accurate ... a critical power plant less efficient.

But achieve the production goal we will without jeopardizing quality ... without interrupting our continuous development program now focused on instruments to help speed victory. And in accomplishing this goal, we will have equipped ourselves to serve even better the new and increased instrument needs of the future ... the needs of America's industry of peace. Weston Electrical Instrument Corporation, 616 Pennington Avenue, Newark, New Jersey.

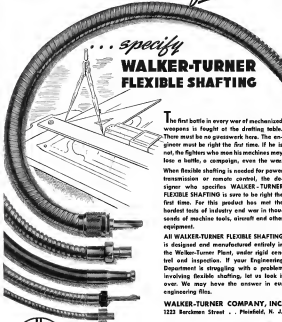
Subsidiary Divisions ... Precision Bell and AC Potentiometers ... Instrument Transformers ... DC, AC, and Thermoelectricity Panel Instruments.

WESTON

Specialized Test Equipment ... Light Measurement and Control Devices ... Exposure Meters ... Aircraft Instruments ... Electro-Techniques ... Dial Transmitters.

FOR OVER 34 YEARS LEADERS IN ELECTRICAL MEASURING INSTRUMENTS

DESIGN IT RIGHT THE *first* TIME!



The first battle in every war of mechanized weapons is fought at the drafting table. There must be no guesswork here. The engineer must be right the first time. If he is not, the fighters who man his machines may lose a battle, a campaign, even the war.

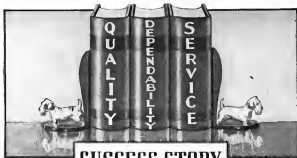
When flexible shafting is needed for power transmission or remote control, the designer who specifies WALKER-TURNER FLEXIBLE SHAFTING is sure to be right the first time. For this product has met the hardest tests of industry and war in thousands of machine tools, aircraft and other equipment.

All WALKER-TURNER FLEXIBLE SHAFTING is designed and manufactured entirely in the Walker-Turner Plant, under rigid control and inspection. If your Engineering Department is struggling with a problem involving flexible shafting, let us look it over. We may have the answer in our engineering files.

WALKER-TURNER COMPANY, INC.
1223 Berckman Street . . . Plainfield, N. J.

FLEXIBLE SHAFTING

FOR REMOTE CONTROL AND POWER TRANSMISSION



SUCCESS STORY IN THREE PARTS

Quality, Dependability, Service —
three words that tell more than
volumes, why each year more
manufacturers buy more Flightex
than any other airplane fabric.

World's Premier Airplane Fabric **FLIGHTEX FABRIC**

FLIGHTEX

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Export Representatives: Douglas, Macomber & Spurr, Inc.
211 Street St. N. E. Cable Address: Douglas

Leading Manufacturers of Fabrics and Tapes for the Aircraft Industry

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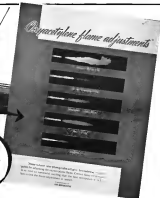
AIR TRANSPORT EQUIPMENT INC. Birmingham, South-Car. N. Y.
HUBB CITY AIRLINES, Los Angeles, Calif.
THE AIRCRAFT TOOL & SUPPLY CO., Wichita, Kan., Dallas, Austin,
Denver, Colo., San Francisco, Calif.
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STUDENT WELDERS LEARN PROPER FLAME ADJUSTMENT FASTER



with
this natural color
oxyacetylene flame
adjustment chart



Student welders and "beginners" learn to make correct flame adjustments more quickly when they are guided by an Airco oxyacetylene flame-color chart. This helpful chart shows full color illustrations of the principal flames used for welding metals.

It makes it easier for the beginner to make sound, strong welds by clearly showing the appearance of the neutral flame which he will use most frequently in oxyacetylene welding.

The excess acetylene flame is also shown, as well as the oxidizing flame used for welding copper and copper alloys.

Since the first requisite to good welds is correct flame adjustment, every student welder will benefit by using this flame chart as his guide.

We will be glad to send you, without charge, as many copies of this chart as you need. Mail the coupon and please indicate the quantity you require.



40 EAST 42ND STREET, NEW YORK, N. Y.
In Texas: Magnolia-Airco Gas Products Co.

AIR REDUCTION Advertising Dept.
65 East 42nd Street, New York, N. Y.

Please send _____ copies of the full color flame adjustment guide to:

Name _____

Position _____

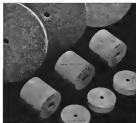
Company _____

Address _____

SOLE CYLINDERS ARE PRODUCTION SLACKERS! KEEP 'EM ROLLING FOR VICTORY!

3 NEW WAYS

to speed output...



1 "WE" WHEELS combine light stock removal with finishing and polishing action. They are long-running and are to be used dry on any portable machine. For breaking down sharp edges on gears etc., finishing and polishing out-of-the-way places.



2 CLOTH CARTRIDGE ROLLS can be mounted on a spindle and used on a portable tool for finishing hard-to-reach surfaces. An abrasive surface wears down, cloth backing rim be torn off to expose fresh layer of abrasive.

CARBORUNDUM PRESENTS 3 NEW "WEAPONS FOR PRODUCTION"

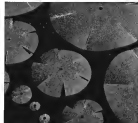
KEEPING pace with the war program, Carborundum has developed many new and novel coated abrasive products—Weapons for Production—to speed output, insure high finishes and lower costs. Here are three of the most versatile and useful. They are particularly adapted for finishing and polishing out-of-the-way places on airplane engine parts and similar metal work.

1. "WE" Wheels are fabricated from cotton fibers intricately intermingled with Abrasive Bead Aluminum Oxide or Carborundum Bead Silicon Carbide grains. They are made in six grades of hardness.

2. Cloth Cartridge Rolls are made in diameters from $\frac{3}{8}$ to 1 inch of tightly wound, gland strips of metal working abrasive cloth. Rolls are from 1 to 5 inches in length.

3. Multi-Spotted Discs afford a time-saving, cost-saving way to bore and polish the edges of holes in metal work. Produced in all necessary grits.

CARBORUNDUM
CORPORATION



3 MULTI-SPOTTED ABRASIVE DISCS simplify the job of removing the burr and polishing the true radius around an hole. Used in a portable power tool, the disc "travels" around and finishing cuts the hole edge. When true circle is rounded up again back to back, they can be used to finish both edges.

THE CARBORUNDUM COMPANY, NIAGARA FALLS, N. Y.

Sales Offices and Workhouses in New York, Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh, Cincinnati, Grand Rapids (Carborundum and Abrasives are registered trade marks and WE is a trademark of and (We) are trademarks of The Carborundum Company)

AVIATION, February, 1942



To win the Battle of Distance

• The job in North Africa is a striking example of what American fighting men and fighting equipment are doing, today, on distant battlefronts. These far-flung theaters of war are supported by supply lines that literally gird the globe. "America can never be better than their supply forces."

• Never before in world history has a nation undertaken such a gigantic transportation job. The growing strength of the United Nations everywhere is a tribute to America's supreme effort in the great battle of distance.

• The Army Air Transport Command, the Naval Air Transport Service and the War Shipping Administration have organized and are directing these amazing movements of men and materials. Due to their combined efforts, huge air and sea fleets are ranging world-wide routes, speeding delivery of the ingredients of victory.

• American Export Airlines and American Export Lines, with giant, four-engine flying boats and new, fast cargo ships, are serving in this battle of distance.

AMERICAN EXPORT LINE'S **AIRLINES**

25 BROADWAY, NEW YORK

AVIATION, February, 1942

WORTHINGTON



THE FASTEST WAY TO KEEP AIRFIELD GRASS CUT to "keep 'em flying!"

— and the most dependable, efficient and economical method available for maintaining airfield mowing schedules is the Worthington Airfield "Grass Blitzer."

The "Grass Blitzer" is a team consisting of a powerful high-speed tractor and a revolutionary type gang mower. The tractor is capable of pulling a 9-gang Mower, cutting a swath of 21½ feet, at a speed of 20 miles per hour. Field conditions naturally affect practical operating speeds. Experience has shown that average speeds of 15 miles per hour can be maintained under normal conditions. At this rate the "Grass Blitzer" team will cut 35 acres per hour, a grass cutting capacity over three times greater than any other make of tractor and gang mower combination now available.

If you have Airfield mowing and turf maintenance problems, why not consult with us today? Write or wire:

WORTHINGTON MOWER COMPANY - Home Office: Stroudsburg, Pa.



RBC AIRCRAFT
SERIES — #4
NORTHROP
N-3 PATROL
BOMBER



NEEDLE BEARINGS



"See the world through a porthole" has been changed to free the world through a bomb-sight—and these Northrop N-3 Patrol Bombers are cruising far and wide to attack the enemy on the open sea or wherever they seek safe harbor. And wherever you find these vigilantes of the air you will find RBC Needle Bearings smoothing the way for efficient operation of moving parts.

ROLLER BEARING CO. of AMERICA
TRENTON . . . NEW JERSEY



Ack-Ack guns that "see, hear, and think"

Men who man our anti-aircraft batteries agree that their job can go on "see, hear, and think." Here's why:

In case of a night air raid, the first clue to hear the enemy bombers are mechanical ears in the Sound Locator developed and continuously improved by Sperry. Far more sensitive and reliable than human ears they can locate enemy planes while they are still many miles away and determine their exact position and the direction of their flight.

While the "ears" have found the planes, the "eyes" of the automatic gun take over. A battery of 60 million beam

radio-power searchlights, the most powerful in the world, spotlights each enemy bomber automatically. So brilliant is the light of this Sperry invention that a man miles away can read a newspaper by it.

While the roaching finger of the searchlight follows the plane across the sky, the "brain" of the gun goes to work. This is another Sperry device, the Universal Director.

Working many times faster than the human mind, this sensory instrument calculates firing data and transmits them to the anti-aircraft gun electrically. Then a Sperry power control mechanism auto-

matically points the guns on the target.

The last act in this amazingly swift-moving drama comes when the men aim down the shaft and press the firing lever. Which they do. And automatically!

Grating "eyes, ears, and brain" for anti-aircraft guns is but one of the many ways in which Sperry is co-operating with our Army and Navy, and helping through precision engineering to solve the problems of a nation at war.

Sperry Gyroscopic Company, Inc.
Brooklyn, New York
Division of Sperry Corporation

SPERRY

PRECISION ENGINEERS TO AMERICA

AVIATION, February, 1945



Completely Cold Forged

HOLO-KROME

Internal  Wrenching

BOLTS

THE ULTIMATE IN QUALITY!

Completely Cold Forged by a method patented and exclusively used by Holo-Krome

unfailing PERFORMANCE

NASC
INTERNAL
WRENCHING
BOLT
SPECIFICATIONS
AVAILABLE

THE HOLO-KROME SCREW CORP.

HARTFORD, CONN., U. S. A.

AVIATION, February, 1945

457

FREEING INDUSTRY FROM GEOGRAPHY'S GRIP...



SYNTHETIC RUBBER

(Made in the U. S. A. from Domestic Materials)

Help Keep Our Fighters Flying

• Acadia Engineers are fully qualified to help you find the synthetic rubber product best suited to your requirements . . . and our plant facilities are adequate to produce to closest specifications. Discuss your problems with them—write us today.

**Acadia Synthetic Products Division
WESTERN FELT WORKS**

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ACADIA

PROCESSORS OF SYNTHETIC
RUBBER AND PLASTICS • SHEETS •
EXTRUSIONS • MOLDED PARTS

Synthetic
PRODUCTS



Largest Independent
Manufacturers and
Distributors of
Rubber and Plastic

Now you can get a **SMOOTHER RIDE**
Without Rubber Wheels

for... FRAGILE MATERIALS
HIGH EXPLOSIVES
ELECTRICAL EQUIPMENT
DELICATE INSTRUMENTS
HIGHLY POLISHED PARTS



Here's the new **BASSICK "FLOATING HUB"**

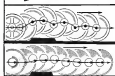
—the engineered center that will save Millions of Pounds of War-Essential Rubber—and yet do a **Better Materials Handling Job.**

**BASSICK "FLOATING HUB"
SMOOTHER THAN RUBBER!**

If you have a problem in materials handling where rubber used to be considered essential, Bassick engineers are ready to search with you without cost or obligation. Write us, addressing The Bassick Company, Bridgport, Connecticut.

**THE BASSICK COMPANY
BRIDGPORT, CONN.**

Division of the Stevens-Warner Corp., Chicago, Ill.
Canadian Division: Stevens-Warner Canada Corp.
Toronto and Canada Ltd., Belleville, Ontario.



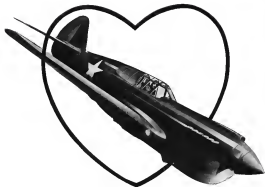
THIS INFERIOR LINE
shows the bouncing action of even a rubber-loaded wheel, when carrying a heavy load, by line of travel of wheel hub.

THIS STRAIGHTER LINE
shows the smooth travel of the Bassick hub, supporting shocks and bumps.



BASSICK "FLOATING HUB"
It's now being used on all types of roller loads in aircraft factories, on truck ground support equipment, on delicate instruments, on highly polished parts, and where your wheels are.

Bassick *FLOATING HUB* **Casters**
• Never • Bounce • the • Load •



"Heart-Beat" timed to the split-second!

★ One three-hundred and sixty-fifth of a second to be exact! That's the amazing speed with which a pair of contact points in the magnets of a modern atomic clock meets, passes a charge of electricity and "breaks" apart again. Twenty-one thousand nine hundred times a minute. Minute after minute . . . hour after hour (the world's fastest "beam-heat" must be maintained).

* **WILES AERALLERY CONTACT FRONTS** are the choice of leading aircraft designers seeking for the grueling job. The result of more than twenty-five years' research in the development and micro-processing of precious and semi-precious metals for industrial applications, AERALLERY has proved its dependability in Army and Navy aircraft, as well as in leading commercial airlines.

* America's aviation industry also knows Wilco for its THERMOMETALS (Thermosetting Bi-Metals) for use in aircraft engine oil temperature controls, for compensation in voltage regulators and in other aircraft indicating devices.

* Wilco will gladly send you full information regarding ADAMALLOY CONTACT POINTS and Wilco Thermostatic Bi Metals in a free booklet: "Wilco Blue Book of Thermostats and Electrical Contacts."

THE H. A. WILSON COMPANY
105 Chestnut St., Newark, N. J.
Branches: Chicago • Detroit



WILCO ELECTRICAL CONTACTS and THERMOSTATIC BI-METALS



☆ To bring Peace to this mad world, we are sending our Bombers over the "Land of the Rising Sun", warned by American boys protected by "clates made of silk."

Our entire production of parachutes is being devoted to the service of our Armed Forces. Before the war Swift's chutes were used by the majority of pilots in the United States, and we are preparing now to accommodate the requirements of a tremendously expanded aviation industry after the war.

Hansen 11

By constantly redesigning and improving our 'chairs' by incorporating more safeguards, finding better materials, developing better workmanship and lowering the cost. Our specifications are now, and always have been, more rigid and exacting than even those laid down by the National Civil Aeronautics Authority.

So, when the last battle has been won, you will find us prepared to meet the needs of America's new army of politicians.

Fourthly,

Shirley Palmer
President

SWITLIK PARACHUTE COMPANY
AMERICA'S LARGEST MAKERS OF PARACHUTES
TENTON, NEW JERSEY

THE NEW YORK TIMES—“Knowledge for Today” may be hard for a man not sharing my spirit, actively and collegially to accept. This volume does challenge the structures, habits, modes of consciousness and use of knowledge. While it is addressed to Seattle, Portland, Eugene, Gracely, H. L.



"ALL BACK SAFELY!"

Some of them homered up a bit from the ack-ack at St. Nazaire... but every busy one of them bucked safely. These great American bombers that fight with permit ships and come out on top are daily brightening up the headlines with their ability to "get there and back".

Helping to provide these formidable planes of the air with this unique ability are wartime "mammoth utilities" such as the Flexible Low-Tension Shielded

Cable made by American Metal Hose. Because of it, pilots and other crew members get their instructions clear and undistorted... Static interference can't mess up their teamwork as a combat group.

American Metal Hose produces Flexible Low-Tension Shielded Cable and a complete line of cable fittings in accordance with A-N, A-C and NAF specifications.

As an extra service to airplane manufacturers and in the interest of conserving valuable time, American Metal Hose is prepared to make complete assembly of cable and fittings according to individual specifications.

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American
AVIATION, February, 1943
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protect the engines *That take 'em there and bring 'em back!*

• In Libya, Australia, the Solomon and all other fronts where our flying forces, airplane maintainers equipped with AAF Filters stay continuously on the job 10 times as long as those without them!

Dust—due to main-shift and temporary air fields in combat areas—is today a vital problem of maintenance at the front, just as it is a major problem of maintenance in the production of planes and war materials at home. In airplanes and machines tool plants, and engine parts, armorers, foundries, synthetic rubber and plastic plants, etc., AAF Dust Control equipment has proved itself essential to all-out production.

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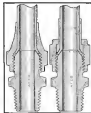
A few of the twenty-three types of AAF Airplane Engine Filters

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Our nation's armed forces have honored us with the Army-Navy "E" flag, for excellence in war production. We are proud of that flag, proud of our skilled craftsmen who made possible the winning of the award. ★ But, none of us in the aviation field can rest on our laurels. That is why we pledge not only to continue to produce fine fittings to help make our American Air Force the best in the skies, but also to be ready to aid in peaceful days to come when America's wings will be called upon to carry American products to all corners of the earth. ★ The Aircraft Fitting Company, 1400 East 39th St., Cleveland, Ohio...manufacturers of the new "AN" standard tube couplings and pipe fittings.



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Klixon Type D-4362 Switch Type Circuit Breaker. For 1500 volts, 150 amperes or drops of 2.5 inches and below.

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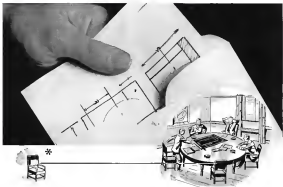
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AMERICA...Where Castles in the Air have had their Feet on the Ground

SOME day, an enemy how long and hard the interim, the first transport load of victorious troops will land for home. Long before we see it, men crowded on its decks will watch a panorama no other shores present.

Tree ridges and spires will appear upon the horizon. Shortly, they will rise and rise until they tower above the ship in the august splendor of an American skyline.

► As our sons and leaders pass ashore, the post-war world will begin—whether we are ready for it or not. It behooves us to be ready.

In a war, it's a good rule to produce weapons in face of defeat, but also to produce peace plans in face of victory... And when we plan for peace, let's see that our "Castles in the Air" have their feet on the ground."

We know our men will come home to a land of tall buildings, fertile fields and swift transportation. Those things were in being when they went away.

But our post-war world will depend upon how we use the tools at hand, not upon the mere fact that we have them.

We could embark upon a vast new expansion of industry, build upon new production techniques and the use of light metals, plastics, and electronics.

We could foster worldwide trade that would raise the living standard of all peoples to our own level.

If we could, why not do it?

► We'll snuff the job unless we keep our air castles tied to the ground. We have the ability and the will, but we may not understand how jobs are made and civilization is spread.

If we hold on to the fact that art, science, political experiments, luxuries AND necessities all rest here their foundations in healthy industry, we will be more careful about doing the things that will keep business healthy.

When we realize that business progress is the foundation of all improvement, our tax laws will stop confining personal profit (salaries and dividends) with irrelevant profits.

► Profit held for reinvestment is the SEED MONEY of business. It is the money a business saves from current operations to insure future growth.

Business will need billions of "Seed Money" dollars when the war is over. But, under the present tax law, they cannot save as they should for that rainy day.

You have lots of talk about the jobs that will result from the transportation automobiles and the airplanes

that industry will build after the war, but not enough talk about the need for SEED MONEY to turn those hopes into realities.

The practical fact is that business cannot adjust itself to post-war production without "seed money."

► "Seed money" will pay for the research that must come before new and better post-war products can be built. It will pay for retooling when new models are produced. It will pay for the study of methods to get the lower costs that will make it possible for more people to buy. It will pay for setting up new distribution and delivery, and for hundreds of other activities that we are involved in the growth of business.

The tax law should be adjusted to allow business to accumulate funds for these necessary tasks of post-war development.

Ask your Congressmen to see that American business is given a chance to create jobs after the war, by revising the excess profits tax so as to leave the "seed money."

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Photograph of 15' dia. Autoclave with Door Open

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Unrusted motor: 150 to 5,000 r.p.m. ball-bearing type set in steel housing, which with locking pin in center of trigger gear and providing right or left hand use, reversible motor in handle for easy replacement.

Weight 3 1/2 lbs.

Use in cramped quarters . . . easy handling



**MODEL AHS 1 1/2"
HEAVY DUTY
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DRILL**

Some specifications are listed. Write for further information.

Both drills are complete with 1 1/2" shafts, covered as specified with right hand thread. Cordless. Cordless covered cable (1 wire for ground) and rubber mounting plug.

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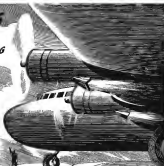
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